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An Asterisk (*) denotes an illustrated article.


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[OFFICIAL NOTICE.]

## American Gas Institute.—Bureau of Information.

AMERICAN GAS INSTITUTE,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 24, 1907.

To the Members of the Institute: The management of the Institute take great pleasure in announcing the formation of a Bureau of Information, composed of the following persons:

| Name. | Subject. |
|---|---|
| W. H. Gartley, Chairman, U. G. I. Co., 22d and Filbert streets, Philadelphia. | Manufacture—Operation. |
| R. B. Brown, P. O. Box 824, Milwaukee, Wis. | Construction. |
| J. D. von Maur, care Laclede Gas Co., St. Louis | Distribution—Ordinary. |
| H. L. Rice, Western United Gas and Electric Co., Aurora, Ills. | Distribution—High Pressure. |
| F. W. Frueauff, 405 17th street, Denver. | Commercial. |
| E. H. Earnshaw, Fourth and Plum streets, Cincinnati | Residuals and Chemistry. |

The members are invited to send *to the Secretary* all questions to which answers by the Bureau are desired. The Bureau will not attempt to do the work of a consulting gas engineer. It will in many cases rather attempt to indicate methods of solution, than actually solve the problem given. Where satisfactory answers already exist to questions asked, the questioner will be directed to these answers. Where the questions are incapable of a positive answer, the questioner will be so told. Where the matter is plainly one for a consulting gas engineer, the questioner will be advised to employ one.

All questions and answers that may be deemed of value to the membership in general, will be recommended by the Bureau to the Directors of the Institute for publication in the "Proceedings."

WALTON CLARK, President.
JAMES W. DUNBAR, Secretary.

*Rules to be Observed in Sending Questions to the Secretary for Answer by the Bureau of Information.*—Wherever possible, all questions should be typewritten. Each question should be on a separate sheet of paper, size approximately 8½ inches by 11 inches. Each sheet should contain the name and address of the member asking the question.

## BRIEFLY TOLD.

A CORRECTION.—In our editorial last week, under the caption of "The Chief's Day," we noted that a feature of the memorable visit of the Society of Gas Lighting to the Astoria plant and the subsequent reunion at the Hotel Astor, we said that the beautiful set of resolutions which were presented to Chief Bradley at the dinner, came from the Society of Gas Lighting. The resolutions were in fact a testimonial to the Chief from the Directors of the Consolidated Gas Company. Everything else, however, that we said in connection with the presentation and the whole affair goes in the truest sense. We take occasion here, too, to reiterate the assertion that it seldom falls to the lot of any man, no matter how prominent he may have been or is, to receive the recognition from his employers, his fellow workers and his intimates as fell to the lot of the Chief the afternoon and evening of the 9th inst.

CURRENT COMMENT.—

IT is now officially confirmed that the property of the Citizens Gas, Electric and Heating Company, of Bloomington, Ind., has changed hands, which fact was developed the 11th inst., when papers announcing the incorporation of the Central Lighting Company, of Indiana, was filed with officers of Monroe county, Ind., by Messrs. W. H. Wherry, Jr., John W. Tobin and Ira B. Meloon, all of New York. The papers set out that the Company is the owner of the gas, electric light and heating plants of Bloomington, Columbus, Shelbyville, Fairmount, Summitville, Alexandria and Elwood, Ind., and that the general capitalization of the operating Company is $3,000,000; which would seem sufficient.

MR. A. N. WAINWRIGHT, Superintendent of the Consolidated Railway Company, of Connecticut, has been authorized to make the following announcement to the residents of the Norwalks:


LIBRARY OF CONGRESS
MAY 20 1907
SMITHSONIAN DEPOSIT

"The Consolidated Railway Company has authorized me to mak certain reductions in the rate for gas in the Norwalk division. In order to have this take effect as soon as possible, I am pleased to advise you that we propose to grant such reduction to take effect as of May 1st, 1907, and including May sales, as follows: The previous rate for lighting to be discontinued, and all sales to be $1.35 gross with 10 cents discount per 1,000 cubic feet for payment on or before the 10th day of the current month, making the net rate $1.25 per 1,000 cubic feet. This reduction is very pleasing to me and will prove much more convenient to our consumers, whereby they can use one meter for all purposes. For the present those customers who are supplied by two or more meters will continue to use them at the single rate, but we propose to remove the unnecessary meters as occasion may require."

THE auxiliary water gas plant for the Clinton (Mass.) Gas Light Company is well under construction and will be completed before the fall season is even underway. This addition to the property was absolutely necessary from more than one cause.

NOTABLE demonstration lectures on the virtues and values of gas as a cooking agent were made early this month, respectively, in Bloomington, Ills., and Brattleboro, Vt. The first of these was under the direction of the Union Gas and Electric Company, of Bloomington, the demonstrator being Miss Vawter, who is certainly making "her mark" on this section of the gas business—possibly the *cuisine corps* will in time demand recognition as Cooking Engineers. The demonstrations were given in the Normal Opera House, and the course consisted of 3 sittings, at 2:30 P.M., of three successive evenings. The demonstration was, as the Chef of the Savarin Café would say, *une success d'estime*. The second course, which was on a much smaller scale, was brought out in Grange Hall, Brattleboro, Vt., by the Twin-State Gas and Electric Company, by Mrs. C. E. Draper, of Hamilton, O. The course covered 4 days, and two sessions were given—each morning and afternoon. The lectures and expositions were so successful, that it may be taken for granted they will be repeated next year, and the year after, too.

A CORRESPONDENT in Cincinnati, writing under date of the 11th inst., forwards the following: "This week Mr. John L. Shuff was a guest at the bi-monthly meeting of the officials and employees of the new business department of the Union Gas and Electric Company, who delivered a very interesting lecture on 'The Opportunities of the Young Man of To-day.' If their interest may be attested by the volume of applause that rang upon the lecturer's ears when his story was told, then not a word that he spoke could have failed of getting into the minds of his hearers. Mr. Walter L. Byron, the Cincinnati Company's Advertising Engineer, also addressed the meeting, and the proceedings were under the able direction of Mr. H. W. Chase."

THAT prince of diplomats, Mr. Sheldon J. Glass, the quiet, mild-mannered gentleman who presides over the fortunes of the Milwaukee Gas Light Company, has even out-McGregored Captain McGregor, of Pawtucket, R. I., as the following (sent us by a correspondent some days ago) rather goes to show: "An information bureau is a new institution inaugurated by the Milwaukee Gas Light Company at the office, 182 Wisconsin street. The central portion of the lobby on the main floor has been railed off for the use of consumers, and the Bureau has been placed inside this inclosure. It is in charge of Mr. F. J. Weckmueller, who is the first person to greet the consumer as he enters. It is his duty to direct visitors to the proper department and to assist them in the speedy discharge of their business. "We expect by the institution of this new Information Bureau," said Gen. Manager S. J. Glass, "to make it easier for our customers to do business at our office. Because of the number of departments anyone entering the office formerly could not always find the department he was after, because we occupy 3 floors. Some customers come to pay their gas bills; a large number, particularly at this time of the year, are making applications for change in meter before moving; still others are about to become consumers, and are applying for service pipes, or for meters, for fuel and illuminating gas. The number in this class has been larger than usual this year, owing to our reduction in price. Every representative of the Company, from the General Manager down, has it as his duty to receive every visitor, no matter how busy he may be; to treat the visitor cordially, and to attend to his wants. Consumers may also feel free to ask Mr. Weckmueller for any information they may desire. The space inside the consumers' railing is covered by a heavy rug. Heavily cushioned chairs are grouped about for the comfort of the visitors. In the center is a large round table, on which are found daily papers and current magazines."

## Sensitiveness of Incandescent Gas Burners to Sound.[1]

According to a short note in *Acetylen in Wissenschaft und Industrie*, published a few weeks ago, attention has been called in Germany to the manner in which incandescent acetylene gas burners sometimes respond to noises in the room where they are alight. The specific case mentioned is one where a hotel supplied with acetylene from a village works was lighted with a number of incandescent burners, one of which jumped very seriously whenever a bunch of keys was shaken in the restaurant, or the door of the oven was violently slammed. On examination, the burner itself proved to be in perfect condition; its jet was not obstructed, and it was consuming gas which contained no air or dust. The other burners on the same service remained perfectly steady. In discussing the cause of the phenomenon, the writer in the German paper gives what is doubtless the correct explanation—viz., that in certain circumstances the mixture of gas and air travelling through the tube of a burner, and changing in speed and pressure according to the conditions locally prevailing, may be disturbed in its steady onward motion by sound composed of vibrations of one or more particular wave lengths, until the gaseous mixture issues from the orifice in a series of jerks, so that the flame changes in shape and affects the manner in which the mantle is glowing. In the German writer's opinion, the trouble is aggravated by dust or any solid particles in the gas, which tend to partially block up the nipple and so reduce the pressure after it. He adds that similar trouble is occasionally met with in coal gas burners, but is much less common and less conspicuous.

As a matter of fact, however, the phenomenon of sensitiveness to sound is fairly common among incandescent coal gas burners, especially such as have been erected by a member of Uncle Podger's family. Any domestic incandescent gas burner, if not already slightly sensitive to sound, can easily be set to be so, generally by checking the gas supply to a point at which the mantle emits rather less than its proper quantity of light. The phenomenon is probably fairly common, as already stated; but when it arises, the jumping of the light is ascribed by the non-technical observer either to an alleged momentary change of pressure in the service, or to mechanical vibration of the pendant or bracket on which the burner is supported, caused by some heavy article falling in the house or by a person walking about the room overhead. It is rather strange that explanations of the latter kind are frequently offered by intelligent people. If the jumping of the light were brought about in the manner stated, the jumping would be irregular, or, if it were due to variations in the service pressure, would occur at slow, regular intervals synchronizing with the change of the chamber from which the gas was issuing in its passage through the house meter.

A little patient investigation of an ordinary upturned "C" burner, or more particularly a "Kern" burner, when the supply of gas is checked, will show that the phenomenon is purely acoustic, and has no connection whatever with any mechanical agitation. The flame alters in shape for an instant in sympathy either with any noise produced in the room, or with noises of a certain character; and the alteration in shape causes the mantle to glow with less than its normal brightness during the period of the disturbance. The flame may, for instance, respond to the shrill jingle of knives and forks touching a dinner plate, but may ignore a bass sound of greater intensity. Sometimes the flame may respond to a rather deep sound and ignore shriller ones. In rare cases a flame may be sensitive only over a limited range of the musical scale, and in still rarer cases may respond in preference to one or two notes only.

In order definitely to establish the fact that the phenomenon of sensitiveness is purely acoustic, the present writer has carried out some preliminary experiments (*a*) with a "Kern" upturned burner supplied with a slightly deficient volume of gas through a fine needle valve, and supported on a pendant in a private sitting room; (*b*) with an inverted "bijou" carried on a bracket fixed to the brick wall of the same apartment. The sources of sound were first the rather loud bell of a "grandfather's clock" standing in the hall, and secondly a metronome placed on a pile of down cushions in a chair in the room at a distance of 10 or 12 feet from either flame. In both cases both flames dipped smartly, and recovered just as smartly, with each stroke of the bell or the metronome—the whole house being perfectly silent and its occupants motionless. The test with the metronome wholly excludes any possibility that the cause of the jumping may be mechanical vibrations communicated to the flame *via* the burner and the gas fitting.

1. *Journal of Gas Lighting.*

In the present writer's experience, sensitiveness to sound can easily be eliminated from, and is, therefore, practically unknown in, well-made upturned burners properly supplied with gas, is rather more difficult to eliminate from inverted burners of the 3-foot size, and is still commoner in inverted burners of the 1-foot size. Perhaps the results observed with one or more individual burners are characteristic of those individual burners only; but whether or not this is the case, some of the results the writer has obtained may be worth attention. Among the so called "bijou" inverted burners used by him in his private house (most of which are of the same make), one was taken at random and placed on a bracket over an upright piano, about 4 feet from the upper end of the strings. However carefully the gas supplied to this burner was adjusted, and to whatever extent the primary air inlets were opened or closed, the burner was sensitive to certain notes of the instrument, responding sharply by a brief decrease in light when one of the notes was struck or when a human being sang one of them. By careful adjustment it was possible to render the light steady for a short time after the burner had attained its normal working temperature. But in every case the sensitiveness reappeared, presumably when some slight unknown change took place in the conditions. Owing to the great trouble caused, the burner was finally removed from its position, and replaced by a "bijou" burner of another make, which only responded to sounds when carefully adjusted with that object. Lighted normally, however, the second burner gave no trouble.

Before removing the former, a few tests were made to ascertain whether the flame was sensitive to the general noise of a piano, to one or more individual notes only, or to the same sound or sounds when occurring as natural harmonics in lower notes. Adjusted so as to give its maximum sensitiveness, the gas supply being diminished until the light was a trifle less than the normal, the burner appeared preferentially sensitive to about a dozen notes of the piano—that is to say, to an octave lying between the first space and the fifth line of the treble stave. When any one of these notes was struck with about uniform violence the light failed; but it recovered fairly quickly and considerably before the sound had became inaudible. When, however, either of the two notes within this octave was struck—viz., the B flat or C natural lying midway—the flame gave two distinct jumps; or, if these notes were struck very gently, gave one drop followed by a very slow recovery. When the sound employed was that of the B natural, the flame drooped three times, and twice when the sound was quite faint; thus showing a distinct accord on the part of the flame with the wave lengths of one particular note—which, if the piano happened to be of standard pitch, should correspond with about 520 double vibrations per second. At an ill-defined point just above the octave mentioned, sensitiveness ceased altogether; the higher notes on the piano being wholly inert. Below the lower end of the same octave, the sensitiveness continued to the lowest note on the piano; but it gave indistinct signs of being most marked in those notes which contained the B flat, B natural, or C already referred to as their earlier harmonics. For example, the B natural above the bass stave caused two jumps in the light if struck sharply, and if struck gently tended to retard the ordinary speed of recovery. The F on the piano which a musician would describe as "F"—*i. e.*, the octave below the first leger line under the bass stave—also caused the flame to jump more than the adjacent notes; but the reason for this occurring is not obvious.

The writer has been informed that in certain conditions upturned incandescent burners of the "Kern" type will occasionally respond in the opposite sense to that already described—the flames jumping in such fashion as to cause a temporary increase in the light during the prevalence of a noise. This, he has been told, may be seen when a "Kern" burner is alight in the neighborhood of a water tap—the light becoming distinctly more intense as long as the water is flowing out of the pipe. Unfortunately, the present writer has had no opportunity of witnessing this peculiar behavior. The whole matter is of some interest to students of physics, because though the old text books describe the sensitive gas flame and experiments that can be carried out with it, the flames referred to in those books are not only luminous rat-tail flames, but are produced from gas under very high pressure. The sensitiveness, of course, has nothing to do with the mantle; but the phenomenon becomes particularly noticeable in incandescent burners because of the very rapid manner in which the light-emissive power of a mantle responds to the flame playing upon it. If a Bunsen burner which gives what is known as a solid flame when burning at, or nearly at, its full power is gradually turned down, a point is generally reached at which the solid flame alters to a hollow flame—the short green inner zone of the solid flame which lies close over the gauze suddenly changing into a conical flame of considerable height. If the burner is so adjusted as to be passing a shade more gas than is necessary to obtain a solid flame, it will frequently respond either to sound or to mechanical vibration; the inner zone jumping up and down with considerable rapidity. Notes sung by the human voice, or whistling, or the noise of hand-clapping will affect the flame, evidently for purely acoustic reasons; but if the bench on which the burner is set be shaken, the same effect is produced, showing that the phenomenon must then be more or less mechanical.

## The Humphrey Crescent Auto-Thermo Instantaneous Water Heaters.

It is beyond question that water heaters of the Humphrey instantaneous type are finding great favor, if one may so assert from a knowledge of the many orders therefor that are being daily received at the Humphrey Company's shops in Kalamazoo, Mich. These heaters are manufactured under the direct supervision of Mr. H. S. Humphrey, and every heater is absolutely guaranteed in every respect as represented. The new feature in these heaters for the current year is that of the combination of supporting shelf and drip pan, which is of white enameled porcelain, so that the rusting out of these shelves is not possible. The burner is of cast iron, and in the Nos. 2 and 6 sizes an additional individual burner is used than heretofore, which practice slightly increases the heating capacity of Nos. 2 and 6 types.

Although the Company's resources were being taxed to the utmost to speedily meet the demands of its customers, the new additions to its factories are such as to enable it to keep pace with its rapidly growing business. These heaters, both as to simplicity and durability of construction, and as to efficiency of and economy in operation, are now so well known that the mention of them is in a sense unnecessary; but to those who would further examine into their merits we may say that the Company will be pleased to forward catalogues describing them in detail.

## The Moore Tube System of Lighting.

At the meeting in March of the New England Section of the Illuminating Engineering Society a paper on the topic named in the heading was read by Mr. E. H. Clifford. For the report thereof we are indebted to the *Illuminating Engineer*.

Whatever type of illuminating source we may happen to be most interested in as individuals, we all have a general interest at least in any new developments in methods of lighting. I, therefore, felt that the Moore tube system of lighting was sufficiently remarkable in character and had become sufficiently standardized and commercialized to merit some few words in regard to it, relative to the system and to its operation. I had occasion this last spring to make some study of the Moore tube system, and whatever may be our feelings as to the advantages or, disadvantages of that system, it certainly has some remarkable properties from many points of view. The Moore tube system makes use of the light produced by a high voltage discharge through a gas under high vacuum. I think there is some misconception about this, perhaps not general, but I have found more or less, as to the particular manner in which the light itself is produced. The tube is of glass, 1¾ inches in diameter and ranging from 20 to 200 feet in length. The pressure of the inorganic gas in the tube is in the neighborhood of $\frac{1}{10}$ of a millimeter, and through this gas is passed a high voltage discharge. In its present commercial operation, the discharge is taken from the secondary high potential side of an ordinary 60-cycle transformer. This differs entirely from the original conception, which Mr. Moore had, which involved the jump spark principle, as I can best describe it, in which the inductive discharge produced intermittently in a tube of gas was relied on for the illumination. The tube is simply run on the lighting circuit and power supplied at 60 cycles. The transformer which produces the high voltage is entirely incased in a steel casing. It is impossible, therefore, unless you break through that casing, to come in contact with the high voltage terminals. From these high voltage terminals

are run in the first place carbon electrodes, and the character of that carbon is highly important in determining the efficiency of the system. These electrodes are sealed in the vacuum tube, and the tube runs about through the area to be illuminated, without wires, without any device absolutely, so far as the source of illumination is concerned, other than the glass tube to which I have referred.

In any system of illumination it seems to me there are certain questions which we all agree as being important, although we may differ as to their relative importance, and I may briefly refer to some of these in connection with this Moore system. In the first place, as to its reliability, I think, so far as my own observations have gone, and, of course, they have been naturally somewhat limited, that there is no question whatever as to the reliability of the apparatus. I have never known in the inquiries I have made of persons using the Moore light, of any such effect as short circuit. I have never known of anyone coming in contact with the high potential. In fact, if the tube is broken the circuit is interrupted, since the tube begins within this sealed casing. It is out of the question even if one broke the tube entirely in his hands for him to come in contact with the high potential.

The life of the tube, as far as can be seen, is very great. I have seen one tube which has been running for 3,000 hours. I could see no blackening near the electrodes or on the electrodes outside of the steel casing itself. Taking the efficiency figures given me at the time the tube was started and comparing these with the efficiency as measured by myself at the time I made the investigation, I could not find that there was any perceptible change.

Electrical discharges which take place in rarefied gases tend to raise the vacuum. That same sort of thing takes place in the Moore tube and it must of necessity be allowed for, and there needs to be some sort of device to prevent this increase which results with a vacuum tube. There has been issued to Mr. Moore, I think in May, 1906, a patent for a particular type of valve which is controlled in its action by the current through the tube. This particular kind of valve, in case the vacuum tends to rise, which is practically the only contingency with which we have to contend, by the slow passage of gas through a particular carbon valve, neutralizes the increase in vacuum in the tube and the normal conditions of running are maintained.

There has been, as I know, some difficulty with that valve. It depends for its action upon the motion of a certain plug through a glass tube. The fitting of this plug to the tube has not been in all cases as desirable as it might have been, and the result is that the plug has stuck in some cases, the vacuum therefore rising, and the performance of the tube has been on that account unsatisfactory. I mean to say that it has not been what would be expected when the tube was operating perfectly. So far, then, as certainty of operation is concerned and so far as the life of the apparatus is concerned, it seems quite satisfactory. It is not the same as if there were any great necessity for what you might call renewal in the tube itself. Of course, I realize in making this statement that there is a necessity for a renewal in case breakage takes place. Occasionally breakage has taken place, although in making inquiries among the users of these tubes that breakage is surprisingly small.

Next, as to its efficiency. The efficiency of the tube itself with the transforming device is somewhere in the neighborhood of 1.4 watts per Hefner unit. Without the transforming device the efficiency is about 1.2 per Hefner. That puts the tube, as far as light efficiency is concerned, in the neighborhood of the best new metallic incandescent lamps. It certainly very closely rivals the tungsten lamp filament. It is not equal to the Helion, but the Helion lamp is not a commercial proposition at the present time. Of course, it excels the tantalum lamp. As to the number of candles per foot, that can be regulated and determined by the amount of current and by the impressed volts. Tubes are run from 5 to 20 candles per foot, standard 1¼ inch tube in each case. Twenty candles per foot is not used except for the so-called photographic tubes, which are intended for high actinic power. Five candles per foot I found in 3 installations, but I found most of the tubes were standardized in the neighborhood of 10 to 14 candles per foot.

Now for some figures in regard to the relation of performance to some of the constants of the tube. During the first 100 hours after the tube is under operation, the Hefners per foot in the particular figures which I have here, rise from about 11.8 to about 13.2. Therefore, up to about 2,200 hours, there was no particular change. There was a very slight increase in the Hefners per foot, the voltage impressed on the tube being quite constant. I take it that the change in the Hefners per foot at first is due to the readjustment of the vacuum due to the passage of the current. I have no doubt there are certain gases on the electrodes and on the walls of the tube which are expelled by the passage of the current. As for the relation between Hefners per foot and the line voltage, it is almost exactly a linear one. Starting with 12.5 Hefners per foot at 200 volts, the Hefners at 220 volts on the low voltage side is about 14 3. You see, therefore, that this brings out another important point in connection with this source of illumination—namely, that the sensitiveness to rise in voltage is very much less than it is in any other source of illumination depending on electricity for its power. An increase of something over 10 per cent. in the voltage causes an increase from 12.5 to 14.3 per cent. in the candle-power; that is to say, less than 10 per cent. for an increase of roughly 11 per cent. in the voltage. Again, the efficiency improves after the tube is started, increasing after the tube has started up to the first 100 hours, just exactly as the Hefners per foot increase. The relation between the efficiency and the line voltage is practically a horizontal line. In other words, the watts per Hefner do not change greatly. That is to say, the change is so slight that we do not need to consider it with a range of line voltage from 200 to 220 on the low voltage side. The Hefners per foot with relation to the total watts per foot is also very nearly linear. Starting with 6.1 Hefners per foot at 10 watts per foot and running up to 25, the Hefners per foot increase to 25. The amperes and the Hefners per foot also form a linear relationship. As to the efficiency of a tube in relation to its length, the watts per Hefner for a tube 20 feet long is about 3.2 and the watts per Hefner for a tube 180 feet long is 1.4. That includes in each case the transformer. The relation between the volts required on the tube and the length of the tube is not linear. In other words, the volts required on the tube do not increase as rapidly as the length of the tube. For a tube 20 feet long the volts required are about 3,500 and for a tube 210 feet long the volts required on the tube are about 11,700, so that for, roughly speaking, 9 to 1 in the ratio of lengths, the increase in volts is about 3½ to 1.

Now, as to the capacity of the transformer which is required. For the longest tube used (about 200 feet), a 4.5 kilowatt transformer is used.

Some of the new developments in the Moore tube are an arc light tube, so-called, which consumes less than the wattage of an inclosed arc and gives more light than the inclosed arc.

An objection, it seems to me, which may be offered to the Moore tube, is its power factor. The highest power factor I know in this tube is 78 per cent. That is in the New York Post Office. The lowest power factor of which I know is 60 per cent. I mean the power factors of which I know from actual experience. That is a real objection to the Moore tube. Unless you can get a power factor which is greater than 60 per cent. we have a very serious difficulty in the use of this source of lighting. But from information which I have received I understand that the low power factor is in very many cases corrected by correcting the valve action, and that a power factor of 60 per cent. is in almost every instance an indication of unsatisfactory working of this controlling valve for regulating the vacuum.

One of the newest developments and to me one of the most interesting developments which has very recently taken place, is the production of the Moore tube which does not return to the transformer. The ordinary Moore tube starts at one of the terminals of the transformer and returns, after running around the room, to the other terminal of the transformer. They have recently been working with a tube of moderate length which does not return to the transformer. Its efficiency I cannot state. It is not at present as good as the efficiency of the tube which does return to the transformer, but it is rather interesting as indicating the possibilities. That, of course, is a matter of some importance when lighting a corridor. If we have got to go up on one side of the corridor and back on the other we are wasting a great deal of light. You may say, why don't you run a few Hefners per foot? You can do that, but not at as good an efficiency, and we have the expense of a double tube.

As to the expense of the Moore tube, it has been greatly lessened. It is now in the neighborhood of 2 or 3 dollars per foot, depending on the length of tube installed. I do not wish at all to give the impression that I am an advocate of the Moore tube system of lighting. I investigated the matter because I was interested personally in doing so and also for others. It is a very interesting method of lighting and it seems to me it possesses advantages utterly aside from its efficiency. Take, for example, an incandescent lamp which we will put on basis on 1-watt per candle. We know perfectly well the illumination we will get with such a lamp will be dependent a good deal on what the candle power unit is, on the use of shades; in other words, on the question of diffusion.

To say that the Moore tube takes so many Hefners per watt, indicates not all that there is in that tube. The diffusion of light is wonderfully perfect.

The light is not glaring to the eyes, in my judgment. I can look at a Moore tube with less trouble than I can look at a mercury lamp and with very much less than I can look at an incandescent light. I took measurements of the after-images and found that the after-image duration is less with the Moore tube than with the mercury light and much less than with the incandescent lamp.

We may speak of the improvement of distribution of the other lamps by means of holophane globes. We may also improve the efficiency of the Moore tube by putting some enamel paint on the tube, and the efficiency is then very close to 1 watt per Hefner.

This Moore tube opens up a very interesting field, and while I cannot join in with all I have heard in its praises, neither can I join in with all I have heard against it. One of the objections against it is that for good efficiency we require a long tube. It is practically, therefore, limited to large areas. There is a tendency to breakage, and of course if it breaks the whole system goes out. There is the advantage, however, that it may be installed after the building has been erected without any disturbance. There does not have to be any concealed wiring so far as the illumination of a particular area is concerned. We have merely the transformer and the tube which gives the light. Of course we have to lead the wires up to that transformer, but so far as the source of illumination is concerned, the distribution of the light is made without wires. What the future of the system is, of course, must be determined later.

*Discussion.*

Mr. W. J. King—Can the color of the light be changed, and if so, how?

Prof. Clifford—There are colors which are standard, exactly as the colors of the flaming arc are standard. There is a golden yellow tube which has the efficiencies which I have mentioned, and also a pinkish tube. Then there is the white tube, which has an efficiency only about half as good. Why that relationship should hold is not quite clear. It holds also for the flaming arc, that the white arc with barium salts is about half as efficient as that with calcium salts. It is the same here. I saw one white tube in operation and made some comparisons of color, and I must confess that it seemed to me that matching was just as good under the white tube as with daylight. These colors I have mentioned are the standard colors.

Mr. King—How are these colors obtained?

Prof. Clifford—I am really in no position to give any information on that particular point.

Mr. N. W. Gifford—Prof. Clifford has quoted Hefners in some instances and candles in others. Will he kindly quote the value of a Hefner?

Prof. Clifford—Eighty-eight hundredths of a candle. The reason I quoted Hefners was that the measurements were made by a standard Hefner lamp. I have not therefore transformed them.

Mr. J. S. Codman—You said the electrodes were carbon. How far do they project into the tube?

Prof. Clifford—The electrodes project into the tube something like 8 or 10 inches, without regard to length of tube.

Mr. Codman—Is the tube self-starting?

Prof. Clifford—Yes, absolutely self-starting. When I first looked at the tube I expected there would be some halting like that of the mercury lamp. When starting with the jump-spark, we have, every now and then, to make a number of contacts before we get the arc going. I tried that—I tried opening and closing the switch again very quickly a number of times and not once did I find the tube fail to respond immediately.

Mr. Codman—You mean to say that the arc will jump several hundred feet?

Prof. Clifford—Yes. Of course there is no reason why it should not do that when we consider the pressure. I tried that by closing and opening the low voltage circuit and even with rapid opening and closing, in no case did I fail to make the arc respond. There was another thing which I noticed that was quite interesting. I do not know the cause, but in the white tube it seemed sometimes almost as if there was sort of a spiral in it. In other words, the steadiness of the white tube on 60 cycles was not so good as the steadiness of the yellow tube, as I looked at it.

Mr. J. W. Cowles—As I remember the latest tubes that I have observed, they had a very pinkish hue. Is that what was referred to as the golden yellow?

Prof. Clifford—Some are pinkish.

Mr. Cowles—They did not impress me as being golden yellow. I assume, however, that must be what was referred to. Has the Moore Electrical Company made any attempt to operate the tubes on direct current systems—that is, by means of motor generators?

Prof. Clifford—You mean on alternating system so far as the tube is concerned, but supplying the power with a motor generator set?

Mr. Cowles—Yes; I judge that inherently alternating current is essential on the tube end of it. I see no reason, however, why it should not be operated on direct current, although with complications and loss of efficiency.

Prof. Clifford—I do not think it has been tried.

Mr. Cowles—Aside from the standard of efficiency, which would be more desirable, the yellow or the white light?

Prof. Clifford—The candle power per watts is bound to be higher in lights which have a yellowish tinge. Personally I am satisfied by the yellow tube little better than I am by the white. Of course in color working the white tube has decidedly the advantage. If we try to match colors under the yellow light, all our yellows are accentuated and all our blues are deadened, but with the white light we can match delicate lavenders, etc., and we may also match colors at the red end of the spectrum as well. It is rather a psychological question, it seems to me, as to what light seems most satisfactory to be used for daily comradeship, so to speak. The white light seems to me cold, and I had the impression that it was blue when I first saw it, but it seems a very good white. I, however, prefer to stay under the yellow.

Mr. W. E. Holmes—If a 4½ kilowatt transformer is required for a 200-foot tube, would the proportion be the same for a different length of tube?

Prof. Clifford—Tubes 40 to 70 feet long use a 2-kilowatt transformer; 80 to 125 use a 2½-kilowatt; 130 to 180 use a 3½; 190 to 220, a 4½. It does not increase quite with the length of tube.

Mr. Codman—Is the nature of the gas a secret?

Prof. Clifford—I do not know that it is, but I do not happen to know the various gases they use.

Mr. Codman—Is the frequency of 60-cycles essential?

Prof. Clifford—Only in this way, that the tubes do not work as well on 25 as on 60 and not as well on 60 as 133.

Mr. Codman—How does the power factor vary with the length of tube?

Prof. Clifford—That is something I cannot answer. The only tubes on which I measured the power factor were the longer tubes and I have no information as to how the power factor varies with the length of the tube. All those I have measured were installed in rooms of considerable size.

Mr. Campbell—What effect, if any, has the temperature—winter or summer—on the tubes?

Prof. Clifford—I think so far as my information goes it has none. The tube, so far as I could judge, runs cooler than the mercury arc tube. This I found by placing my hand and cheek against the tube.

Mr. A. Sampson—Is mechanical injury likely to affect it in common practice—say vibration, etc.? Do they get punctured very often?

Prof. Clifford—That is a difficult question to answer, for the reason that there are not many of these tubes in use, comparatively; but I cannot find that people who have used them have suffered much from breakage of tubes due to vibration or from settling. In the instances I have in mind where tubes have been broken, it has been by injuries entirely apart from such causes.

Mr. Sampson—Are these joints made up as regular sealed joints? Are they blown in?

Prof. Clifford—The tubes are put together simply by the regular glass blowing process.

Mr. Sampson—In case of a broken tube, I suppose it must be sent back to the factory?

Prof. Clifford—That, of course, is a real difficulty at present. If one had an installation here in New England there is no place nearer than New York to procure a tube. You see, the amount of feet of this tubing installed is not great at present. It is several thousand feet, but it is not great as such things go. The result is that the number of agencies is limited. It seems to me that those who are installing this system have the courage of their convictions. I know there was a plant recently installed just outside of Springfield, Mass. Of course, there is nobody here in the New England States who can make repairs on that tube if anything goes wrong, so that it is a real difficulty at present.

[Communicated by "R."]

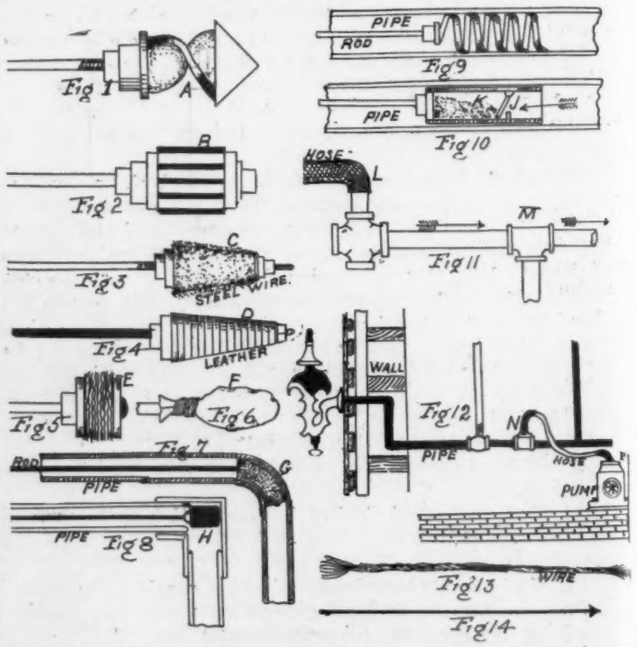
## Cleaning Out Gas Pipes.

Some men go about the country cleaning out boiler tubes while others are employed as chimney sweeps, and there are men who devote their lives to the cleaning out of flues and related devices for the conveying of heat, smoke or steam from point to point in buildings of all kinds. Likewise, there are those who make a business of cleaning out ventilating pipes and boxes. Again, we have the man who undertakes to clean out your gas pipes from the bottom of the house to the top, at the same time contracting to relieve the gas tips and points of all unnecessary refuse and clogging substance. These men will arrange to overhaul your gas supply from the source of delivery of the gas in the mains to the tips of the burners. They will get all foreign stuff out of the way, and have specially designed contrivances with which to clean out all gas pipes from the gas meter up. It may be interesting to notice some of the contrivances thus employed. First, is exhibited one of the plain, spiral-screw patterns of cleaner, constructed by using a threaded metal shaft, to the end of which is screwed the device of the design presented. This device is forged out of iron, and is tempered. The headpiece (*A*) is fitted with the wings or curves, as shown, shaping the screw. As this device is revolved the blades of the screw force the accumulated masses of stuff outward. The butt of the device is furnished with a point so that it can be chucked inward against a mass of clogging matter. The instrument is intended to use when there is a packed mass of stuff.

Not infrequently sooty stuffs gather in the pipes and, becoming dampened, they harden, and these collections of material are difficult to remove. Often the pipe has to be opened in order to remove the baked contents. In the event that the mass is not packed too hard, the scraping cylinder *B*, shown in Fig. 2, can be utilized with good results. This cylinder consists of a round section of metal, which is secured to the terminus of the metal rod by means of a threaded tip. The cylindrical piece is properly grooved to receive the slats, the latter being thin pieces of steel, fixed securely in the position shown. Therefore, these edges scrape on the gathered masses of foreign matter in the pipe and break and move the same. When the masses are broken it is possible to remove the stuff by means of the cone shaped section of steel wire. The wire is adjusted, as at *C*, between the flanged ends of the bob, hence it is only necessary to revolve or push inward and outward on the handle to make the bob act upon the interior surfacing of the pipe. Soon the inner walls of the pipe are quite thoroughly scraped. The loosened matter is readily removed by drawing the handle of the drive to-and-fro. Then there are means by which the interiors of gas pipes are cleaned with leather disks arranged in a tapering bob, as shown in Fig. 4. The bob is made of a cylinder of iron, with inner and outer flange, and the disks of leather of tapering sizes are screwed between the flanges on this, as shown. This bob is marked *D*. Then there are forms of rotating cleaners, one of which is shown in Fig. 5. The bob is manufactured with the customary shaft, on which the flanges *E* are fitted, with the intention of drawing up the same on the disks of fabric or scratch material. The wire card clothing of the textile cotton and woollen carding machinery has been used for this purpose. The disk with the protruding points of fine steel is revolved in the hollow of the pipe and the cleaning operation begins at once. Then there are certain pads which are used for cleaning gas pipes by some men. Fig. 6 illustrates one of this character. It is made of leather, in bag-like form, fitted over the end of the wood pole, and properly packed with excelsior or hair. This stuffed bag *F* is drawn back and forth and repeatedly turned within the walls of the gas pipe until the latter are clean.

There are, of course, many types of push plugs used, one of which is illustrated in Fig. 7. In this diagram is shown a section of a pipe with the head of the cleaner inside at *G*. The rod is used to push the spongy head back and forth, but as the head is checked at the curve it can go no further. Flexible cleaners are always selected by the gas pipe cleaners who understand what is needed. They will not make or buy the description of cleaner shown in Fig. 8. This form of cleaner is defective in that it cannot go beyond the square turn in the gas pipe. You will find workmen trying to get around these square turns with flexible wire and rattan. In fact all kinds of things are used in desperate efforts to get the pipes free of foreign stuffs.

There are types of spiral screws of the order shown in Fig. 9 on the market. This style of pipe cleaner can be used to good advantage in removing clogging articles. The man who is not accustomed to travel much outside his own province would be astonished if he were to know how many defective piping systems exist which must be cleaned regularly or take the chances of gas explosions, leaks and wastages. I have seen some very good contrivances in service for this work, and again I have noticed some very cumbersome and useless ones. Fig. 10 is an odd contrivance for effecting this end. The device is much like a boring tool for excavating a tube line for an oil well. There is a steel cylinder used, which cylinder is fitted with a valve at *J*; therefore, when the operator moves the cylinder forward by means of the hand rod the valve is forced open by the presence of the foreign stuff. Then, when the operator draws the instrument back, the valve closes and the stuff is caged in at *K*. The valve is marked *J*. But there are other types of gas pipe cleaning devices, operated entirely by steam or air. In case that the pipes are clogged with solid matter, the spiral screws or the metal pointed devices must be used; but if the matter is loose it is easy to blow it out with the steam jet devices or suck it out with the air pressure apparatus. One of the steam blowing plans is presented in Fig. 11. An opening leading into the pipe is quickly effected by unscrewing one of the joints. Or perhaps a "T" can be located and a section of pipe screwed in. Then the rubber tube line is set over this pipe as at 1, Fig. 11. The steam pipe connection is made with this same tube by extending it to the hot water supply of the building. The steam is let into the pipe system with considerable force, and after blowing for a time, and softening hard matters with the moisture of the steam, most of the stuff is discharged out the other end, along the line of *M*.




Then there are times when, instead of using the steam jet, air is pumped all through the system in the building, something as displayed in Fig. 12. The air pump is adjusted below the floor in the basement, as at *P*, and is set to work forcing air upward through the hose or tube to an inlet cut into the pipe, as at *N*. The force of the air serves to blow out much of the free stuff and leave the pipes clear. The thing is helped along by using the combination wire cluster shown in Fig. 13. This is made of light copper strands, twisted hard together, thereby making a very strong push rod, which at the same time is exceedingly flexible. It can be used in considerable length to enter pipes which make turns. A common steel shaft with the arrow head is convenient to dislodge obstructions in straight pipes, one of which is shown in Fig. 14.

## Test of a Producer Gas Engine.

The *Electrical World* notes that Prof. G. W. Bissell, of Iowa State College, Ames, Ia., presented a paper before the Iowa Electrical Association at Clinton, Ia., April 19, 1907, on "Producer Gas Engines." Much of the paper was taken up with a review of certain tests made by the United States Geological Survey during the Louisiana Purchase Exposition at the government testing plant there. The tests which might be of interest to Iowa central station men were summarized, coals being selected which were similar to Iowa coals in their composition. These tests can be studied in detail by referring to Bulletin No. 261 of the U. S. Geological Survey, obtainable by application to the Survey at Washington. The latter part of the paper is devoted to a

test on a hard coal producer gas engine at Algona, Ia., in 1906. The results are shown in Table I. The engine was a 3-cylinder, vertical, Fairbanks-Morse engine, using gas generated from anthracite pea coal in a suction gas producer, also manufactured by the Fairbanks-Morse Company. The unit is rated at 150-brake horse power at 250 revolutions per minute, and was guaranteed to give 1 brake horse power hour for not to exceed 1½ pounds of anthracite pea coal for all loads above 75 brake horse power.

TABLE I.

| Revolutions per Minute. | Brake Load. | Pounds Coal (as fired) per Brake Horse Power. | Cost per Brake Horse Power at $6 per Ton. |
|---|---|---|---|
| 250 | 40.1 | 1.511 | $0.00453 |
| 250 | 82.7 | 1.157 | .00337 |
| 250 | 156.9 | 0.999 | .00299 |

Two tests were also made on this engine under service conditions, viz., belted to a 75-horse power alternating current generator. In addition to the lighting load, electrically driven pumping machinery can be operated from this generator. Fig. 1 shows the load curve (*A*) during a service run with lighting load only and the load curve (*B*) for the combined load, the usual operating conditions, stand-by losses included.

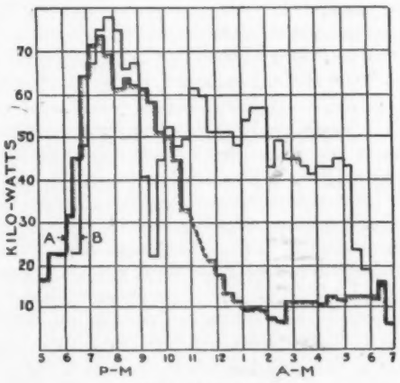



Fig 1.—Load Curves.

At $6 per ton the cost of fuel per kw-hour at the switchboard for the load *A* was 1.207 cents including fuel for banking and starting, and for the load *B* was .639 cent, including also the stand-by losses. Soft coal from Illinois which was used for a Corliss engine unit in the same plant cost $3.40 per ton.

The following data apply to the curves *A* and *B*, Fig. 1:

*A*.—LOAD CURVE OF ALGONA PRODUCER GAS ENGINE, March 15-16, 1906.

14-hour test. Output 409 kw-hours.
Anthracite pea coal per kw-hour = 4.10 pounds.
Fuel cost per kw-hour = $0.0123.
Load factor 18 per cent.

*B*.—LOAD CURVE OF ALGONA PRODUCER GAS ENGINE, March 16-17, 1906.

12-hour test. Output 589 kw-hours.
Anthracite pea coal per kw-hour = 2.23.
Fuel cost per kw-hour = $0.00699.
Load factor 27 per cent.

For the purpose of comparison with this test, we may consider the case of a simple Corliss engine similar to that used in the government tests at St. Louis. The average coal consumption of that engine was 5.71 pounds per kw-hour. If this coal cost $3 per ton the cost of the coal per kw-hour would be $0.008565, which can be compared directly with the values given in connection with the Algona test.

It is difficult at this time to predict the immediate future of the producer gas engine, but the writer stated that this type of prime mover is destined to be a formidable rival of the steam engine, and as the price of fuel increases the field for the producer gas engine will enlarge. At present there is a question whether it will pay to install a producer gas engine where coal is cheap. The only advantage would be the compliance with the smoke regulation, but as a financial proposition it may be stated that owing to the fact that a producer gas engine installation costs probably from 50 per cent. to 60 per cent. more than a steam engine plant which would be its alternate, it will not pay to consider the installation of the gas producer plant with coal costing $1.50 or less per ton.

The question of the mechanical and operative advantages and disadvantages of the gas engine will not be discussed here except to say that there is no reason why the gas engine cannot be used satisfactorily for the generation of electrical energy for lamps and motors.

At the close of the paper Prof. Bissell asked as to the difficulties of oiling gas engines. He replied that the vertical cylinder type was said to be hard to oil and for that reason many thought the horizontal engine better. With horizontal engines there seemed to be little trouble. Being asked as to the steadiness of speed, he said that a multiple cylinder engine with a heavy flywheel was sufficiently steady. Single cylinder engines were likely to be unsteady unless equipped with very heavy flywheels. He thought it rather important in operating gas engines that they be placed in the hands of men who are in sympathy with the gas engine idea. They are entirely different from a steam engine, and if the engineer does not like them they are not likely to get the right kind of attention. Mr. Austin Burt said the same thing was true in connection with introducing steam turbines.

## Influence of Lengthy Storage of Coal on Coking Qualities of Same.

Mr. F. Hannack, in the course of an article on this subject, which article was origially prepared for "Stahl und Eisen," says that bituminous coal, when stored in the open for some time, loses a considerable quantity of gas, the amount so lost being increased when the coal is small and in damp state (with 12 to 15 per cent. of water), as in case in storage towers. From a number of recent experiments, it appears that the average loss of weight sustained by the coal in a week is about 1.7 per cent. Now in a cokery of 50 ovens to be emptied and refilled daily, each with a charge of 7 tons of slack, it is necessary to keep a stock of 700 tons of coal in order to insure regular working. This quantity will lose 10 tons of gas in 48 hours, equivalent to a loss of 1,870 tons of gas per annum, and corresponding to a considerable diminution in the output of by-products. The loss of ammonia is especially apparent, the coal used in the experiments containing 1.37 per cent. of nitrogen, about 50 per cent. of which is recovered as ammonia when the coal is used fresh. Moreover, the loss of gas is attended with certain difficulties in the management of the ovens; for instance, the heat can only be uniformly maintained when there is a sufficient volume of gas available, and when this is absent, the fluctuations of temperature cause unequal strains in the brickwork, which then becomes liable to crack. Still another drawback of storing the coal is that the coke is never first-class with regard to size, the presence of an abundance of gas greatly facilitating the caking of the coal in the oven.

Wedding explained the phenomenon of coking by the assumption that the hydrocarbons in the coal are decomposed at high temperature, ethylene, for instance, being split up into carbon and methane, the small particles of this carbon then cementing the small lumps of coke together. When the coal is poor in gas, the formation of these particles of carbon in sufficient quantity is precluded, the coal cracks and powdered coke is the result; more labor being required to sort out the spongy lumps from the hard, resonant good coke, to say nothing of the softer coke breaking to pieces in transit and giving rise to complaints on the part of the consumer.

## Tar in Road Construction.

At a meeting of Municipal Engineers, held in the Surveyor's Section of the Building Trades Exhibition, last month in London, England, Mr. A. Dryland read the following paper on the topic named in the heading:

Modern developments of traffic by self propelled vehicles, deriving their propulsion from wheel friction with the road surface, have led to an immense increase in the use of tar, in various forms of application, to prevent the disturbing effects of this frictional wear, and, incidentally, the raising and distribution of the dust particles present on all macadamized roads as commonly formed. The larger proportion of this dust is due to foreign matter either blown or deposited upon the highways, and to excess of binding material; but a considerable amount is caused by the wear due to common forms of traffic. There is no doubt that increased abrasion of the surface, and consequently more dust, is the result of the wheel friction propulsion before referred to; and fast-moving vehicles of this kind, as at present constructed, form most efficient dust raisers and distributors. It will be contended, no

doubt, that horse drawn vehicles are propelled by friction, by means of horses' hoofs. This is perfectly true; but it was so distributed and minimized by the muscular form of application that the dust trouble, previous to the increase of self-moving vehicles, was not of sufficient importance to cause any particular anxiety to the road engineer.

The "wear and tear" and "dust" problems are now the important questions, troubling not only the road engineer, but all users of, and residents near, our important thoroughfares. The solving of these problems does not rest entirely, or even chiefly, with the road engineer, because there must always be a considerable quantity of dust upon roads from other sources than wear; and motor engineers could, and should, do much by improvements in design to lessen the dust-raising powers of the modern motor car. But the devising of some reasonably perfect form of road surface, obtainable at a modest cost, would confer an immense immediate benefit upon the whole community.

The ideal road surface for such a purpose would seem to be one smooth and firm, yet slightly elastic to give a good foothold, composed of materials sufficiently strong to give off the smallest quantity of dust by abrasion. The attempts at providing such a *desideratum* have been largely confined so far to the application of tar, mostly in the following ways: (1) Tar concrete; (2) tar grouting, and (3) tar painting and spraying. I will deal shortly with these under their respective heads.

*Tar Concrete.*—For many years tar concrete has been used for roads; but until recently it has been principally confined to providing surfaces for highways of light traffic in towns. The author, more than 20 years ago, converted several miles of boulder-paved narrow streets in a seaside town to tar macadam roads composed of broken flints from the seashore and burnt shingle obtained from the same source. Though the materials were by no means ideal, the purpose of providing a clean and comparatively noiseless roadway was served; and with annual surface dressings of tar and fine shingle, and small repairs, these roadways are still, he believes, good and efficient. In several seaside towns, tar concrete compounded of limestone has been in successful use for many years as a road material. More recently tarred slag has been largely employed, and with a considerably, although varying, degree of success. Experiments on a considerable scale have been made with basalts, granites, and quartzites as the aggregate for tar concrete. With some of these there have been failures. It has always appeared to the author that the adhesion of the tar to the aggregate was the secret of success in tar concrete. A good deal has been said and written about the "impregnation" of the material forming the aggregate of the tar. The author would like to elicit opinions as to this impregnation; his personal view being that a material that is sufficiently porous to absorb gas tar to any considerable extent is not of a sufficiently durable character to withstand any considerable traffic. The author's view is that the principal requirement is a hard material which breaks with a sufficiently rough surface to form a good adherence for tar. Many of the hardest and finest grained road materials are, in the author's opinion, unsuitable because of the clean, smooth surfaces left by fracture.

As to the preparation and laying of the concrete, the following are, in the author's view, essential points:

1. An aggregate of the character before suggested, free from dirt or dust, with all moisture expelled by artificial heat.
2. Well-boiled gas tar—that known as "distilled tar" being preferable—applied to the heated aggregate at a temperature closely approaching boiling point.
3. The thorough admixture of the ingredients in such proportions as will insure the coating of every particle without an excess of tar; the quantity needed varying with the kind of material and the gauge.
4. The ripening of the material, previous to laying, for a period of 4 to 8 weeks in bulk.
5. A firm and true foundation.
6. A coarse aggregate for bottoming, not less than 2½-inch gauge, and topping not less than 1½ inches for roads having any considerable traffic, with a total thickness of 4 inches at least.
7. The material should be laid on a dry surface, be thoroughly rolled, and receive a top dressing of a small amount of clean stone or slag grit.

Varying success has attended the use of tar concrete; but the author thinks that when it has not been successful, this has been due to want of attention to some of the above-mentioned details or to bad weather interfering with the work when in process of laying. There are, no doubt, limits to the ability of the best tar concrete to withstand traffic, just as there are to the best ordinary macadam. In the author's opinion, it is more liable to be a success on open roads than in damp or perpetually shaded situations; excessive moisture being deleterious to the life of the tar.

*Tar Grouting.*—By this the author means the use of tar in some form in place of the usual slurrying of ordinary macadam roads. It has been used with considerable success, especially when followed shortly after by a surface dressing of tar and grit. It is of the utmost importance that the whole operation of laying the macadam and the grouting should be performed in dry, warm weather, when both the road and the material are perfectly dry; and the metal should be firmly consolidated before the tar is applied. The author has seen successful results obtained by this method with a top dressing of clean ¼-inch basalt chippings. Under this head reference might be made to the system of spreading the metal upon a layer of fine and rather moist tar concrete, and rolling until this is forced upwards as a grouting. The author has not seen this carried out; but he sees no reason why it should not meet with considerable success, especially if followed by a top dressing.

*Tar Painting and Spraying.*—For both of these operations a very dry road is essential and hot weather a great advantage. Moisture in the road surface will prevent proper adhesion of the tar. A newly coated road surface is also necessary to any considerable measure of success. When once the surface has become worn and compacted the tar cannot penetrate sufficiently and a thin film only is formed, which is destroyed by wet or frost.

Another most important matter is the thorough removal of dust from the surface and between the stones, to permit a sufficient key. All those who have had much experience in the application of tar know that it refuses to penetrate fine, dry dust, and will realize the importance of thorough brushing. It has occurred to the author that if a suction process, similar to that in use in the "pneumatic cleaner," could immediately precede the application of the tar, it would be advantageous. Perhaps some of the designers of tar-spraying machines may develop this in some practical form. The deeper the penetration of the tar the nearer the success of the process of tar painting or spraying will approach tar macadam; and removal of dust to a good depth is essential to penetration. Attempts at injection by force will, in the author's opinion, fail unless the dust is thoroughly removed.

Within the limits of so short a paper, it is impossible to deal fully with all the points and processes which have been tried with more or less success. The author, therefore, desires to call attention to certain points with the view of eliciting discussion; and he would suggest particularly as worthy of consideration the following: (1) The suitability of tar macadam for heavy traffic and the best kind of aggregate to withstand it. (2) The size of aggregate and the thickness required. (3) The best top dressing. (4) Tar grouting and the increase of life of a macadam road thereby. (5) The best means of tar painting or spraying and the preparation of the road surfaces for the same. (6) Reliable figures as to the cost of carrying out the different processes. (7) The life of roads treated by any of these means as compared with that of ordinary macadmized roads laid with high-class materials in the best possible manner. (8) Experiences as to disintegration of tar-treated roads, and the cause.

## Electrolytic Valve Cells.

In this most interesting article, which was written for *Engineering*, the author says that in spite of all that has been written on electrolytic valve cells, which are also styled "electrolytic condensers" or "rectifiers," though the terms are not identical, it is not easy to picture to oneself the way in which these cells act. An electrolytic valve cell consists of two electrodes immersed in an electrolyte, the combinations being such that through the chemical reactions the one electrode—generally the anode—becomes covered with a skin of some compound, which prevents the current from flowing in that direction. If we place such a cell on an alternating circuit, the pulses in one direction will be stopped, but those in the other will be able to pass.

The anode consists, as a rule, of aluminum; the metals of the rare earths, and those with which the search for new lamp materials have acquainted us, tantalum and niobium, further antimony, bismuth, cobalt, and, in certain solutions, copper, will also answer. The cathode is made of carbon, lead, iron, etc. The electrolyte may be an acid, alkali, or a salt solution; many electrolytes have been tried with varying degrees of success, sulphuric acid and sodium phosphate perhaps most frequently. The aluminum covers itself, as anode during the formation period by direct currents, with a thin skin of oxide, hydrate, basic sulphate, phosphate, etc.; the skins are exceedingly thin, and their chemistry is not well established. Under special conditions thick skins can be produced; whether the thick coatings of bluish-grey basic sulphate, which Franz Fisher produced on cooled tubular electrodes,

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## A Notable Way of Moving a Lighthouse.

Some time ago a notable feat in the moving line was accomplished when 12 men in 4 hours' time moved the 65-foot 65-ton range lighthouse at the Ashtabula, O., harbor, a distance of 750 feet recently, to accommodate improvements being made by the Pennsylvania Railroad Company. The lighthouse is a frame structure covered with metal, 18 feet square at the base, 65 feet high and of a total weight of 65 tons, and prior to moving it was not dismantled at all.

Jacks were placed under the building and, as it was raised, 4 guy ropes were used to steady it. After being suitably blocked up it was next placed on rollers, and by alternately moving the building and loosening and tightening the guy ropes, it was soon deposited on a lighter which lay in the main river next to the dock on which the range light stood. Whether the towering structure could be held steadily on the moving vessel, or would overbalance and topple into

doubt, that horse drawn vehicles are propelled by friction, by means of horses' hoofs. This is perfectly true; but it was so distributed and minimized by the muscular form of application that the dust trouble, previous to the increase of self-moving vehicles, was not of sufficient importance to cause any particular anxiety to the road engineer.

The "wear and tear" and "dust" problems are now the important questions, troubling not only the road engineer, but all users of, and residents near, our important thoroughfares. The solving of these problems does not rest entirely, or even chiefly, with the road engineer, because there must always be a considerable quantity of dust upon roads from other sources than wear; and motor engineers could, and should, do much by improvements in design to lessen the dust-raising powers of the modern motor car. But the devising of some reasonably perfect form of road surface, obtainable at a modest cost, would confer an immense immediate benefit upon the whole community.

The ideal road surface for such a purpose would seem to be one smooth and firm, yet slightly elastic to give a good foothold, composed of materials sufficiently strong to give off the smallest quantity of dust by abrasion. The attempts at providing such a *desideratum* have been largely confined so far to the application of tar, mostly in the following ways: (1) Tar concrete; (2) tar grouting, and (3) tar painting and spraying. I will deal shortly with these under their respective heads.

*Tar Concrete.*—For many years tar concrete has been used for roads; but until recently it has been principally confined to providing surfaces for highways of light traffic in towns. The author, more than 20 years ago, converted several miles of boulder-paved narrow streets in a seaside town to tar macadam roads composed of broken flints from the seashore and burnt shingle obtained from the same source. Though the materials were by no means ideal, the purpose of providing a clean and comparatively noiseless roadway was served; and with annual surface dressings of tar and fine shingle, and small repairs, these roadways are still, he believes, good and efficient. In several seaside towns, tar concrete compounded of limestone has been in successful use for many years as a road material. More recently tarred slag has been largely employed, and with a considerably, although varying, degree of success. Experiments on a considerable scale have been made with basalts, granites, and quartzites as the aggregate for tar concrete. With some of these there have been failures. It has always appeared to the author that the adhesion of the tar to the aggregate was the secret of success in tar concrete. A good deal has been said and written about the "impregnation" of the material forming the aggregate of the tar. The author would like to elicit opinions as to this impregnation; his personal view being that a material that is sufficiently porous to absorb gas tar to any considerable extent is not of a sufficiently durable character to withstand any considerable traffic. The author's view is that the principal requirement is a hard material which breaks with a sufficiently rough surface to form a good adherence for tar. Many of the hardest and finest grained road materials are, in the author's opinion, unsuitable because of the clean, smooth surfaces left by fracture.

As to the preparation and laying of the concrete, the following are, in the author's view, essential points:

1. An aggregate of the character before suggested, free from dirt or dust, with all moisture expelled by artificial heat.
2. Well-boiled gas tar—that known as "distilled tar" being preferable—applied to the heated aggregate at a temperature closely approaching boiling point.
3. The thorough admixture of the ingredients in such proportions as will insure the coating of every particle without an excess of tar; the quantity needed varying with the kind of material and the gauge.
4. The ripening of the material, previous to laying, for a period of 4 to 8 weeks in bulk.
5. A firm and true foundation.
6. A coarse aggregate for bottoming, not less than 2½-inch gauge, and topping not less than 1½ inches for roads having any considerable traffic, with a total thickness of 4 inches at least.
7. The material should be laid on a dry surface, be thoroughly rolled, and receive a top dressing of a small amount of clean stone or slag grit.

Varying success has attended the use of tar concrete; but the author thinks that when it has not been successful, this has been due to want of attention to some of the above-mentioned details or to bad weather interfering with the work when in process of laying. There are, no doubt, limits to the ability of the best tar concrete to withstand traffic, just as there are to the best ordinary macadam. In the author's opinion, it is more liable to be a success on open roads than in damp or perpetually shaded situations; excessive moisture being deleterious to the life of the tar.

*Tar Grouting.*—By this the author means the use of tar in some form in place of the usual slurrying of ordinary macadam roads. It has been used with considerable success, especially when followed shortly after by a surface dressing of tar and grit. It is of the utmost importance that the whole operation of laying the macadam and the grouting should be performed in dry, warm weather, when both the road and the material are perfectly dry; and the metal should be firmly consolidated before the tar is applied. The author has seen successful results obtained by this method with a top dressing of clean ¼-inch basalt chippings. Under this head reference might be made to the system of spreading the metal upon a layer of fine and rather moist tar concrete, and rolling until this is forced upwards as a grouting. The author has not seen this carried out; but he sees no reason why it should not meet with considerable success, especially if followed by a top dressing.

*Tar Painting and Spraying.*—For both of these operations a very dry road is essential and hot weather a great advantage. Moisture in the road surface will prevent proper adhesion of the tar. A newly coated road surface is also necessary to any considerable measure of success. When once the surface has become worn and compacted the tar cannot penetrate sufficiently and a thin film only is formed, which is destroyed by wet or frost.

Another most important matter is the thorough removal of dust from the surface and between the stones, to permit a sufficient key. All those who have had much experience in the application of tar know that it refuses to penetrate fine, dry dust, and will realize the importance of thorough brushing. It has occurred to the author that if a suction process, similar to that in use in the "pneumatic cleaner," could immediately precede the application of the tar, it would be advantageous. Perhaps some of the designers of tar-spraying machines may develop this in some practical form. The deeper the penetration of the tar the nearer the success of the process of tar painting or spraying will approach tar macadam; and removal of dust to a good depth is essential to penetration. Attempts at injection by force will, in the author's opinion, fail unless the dust is thoroughly removed.

Within the limits of so short a paper, it is impossible to deal fully with all the points and processes which have been tried with more or less success. The author, therefore, desires to call attention to certain points with the view of eliciting discussion; and he would suggest particularly as worthy of consideration the following: (1) The suitability of tar macadam for heavy traffic and the best kind of aggregate to withstand it. (2) The size of aggregate and the thickness required. (3) The best top dressing. (4) Tar grouting and the increase of life of a macadam road thereby. (5) The best means of tar painting or spraying and the preparation of the road surfaces for the same. (6) Reliable figures as to the cost of carrying out the different processes. (7) The life of roads treated by any of these means as compared with that of ordinary macadmized roads laid with high-class materials in the best possible manner. (8) Experiences as to disintegration of tar-treated roads, and the cause.

## Electrolytic Valve Cells.

In this most interesting article, which was written for *Engineering*, the author says that in spite of all that has been written on electrolytic valve cells, which are also styled "electrolytic condensers" or "rectifiers," though the terms are not identical, it is not easy to picture to oneself the way in which these cells act. An electrolytic valve cell consists of two electrodes immersed in an electrolyte, the combinations being such that through the chemical reactions the one electrode—generally the anode—becomes covered with a skin of some compound, which prevents the current from flowing in that direction. If we place such a cell on an alternating circuit, the pulses in one direction will be stopped, but those in the other will be able to pass.

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the water, was an anxious question. Once on the lighter, however, it was slowly moved along to the new site at the end of a concrete pier. Then it was again blocked up and moved on rollers to place, uninjured in any respect.

## A New Business Department for Central Stations in Small Cities.[1]

By Mr. C. E. Stannard.

The working up of the new business of an electric company needs a separate organization in order to be effective. The following scheme is a condensed outline of the organization of such a department, and the subsequent conduct of the completed organization:

The first step in establishing a new business department in cities of 50,000 population and under, should be a careful selection of a manager. Among other qualifications he should be a man of sterling character, having a broad and liberal education; should be versatile and capable of mingling with all classes of people; possessing a thorough knowledge of the electrical business. It is also advisable for him to be well posted on the gas business, thus being able to intelligently meet competition. He should be a man of executive ability and have the faculty of being popular with the public, possessing the ability to manage the employees in his charge.

The city should be divided into 10 territories, containing an average of 5,000 people, or 1,250 families. Then subdivide each territory into 2 districts, 1 a residence and the other a business. Thus the representatives would have an opportunity of working both classes of trade.

The best plan of compensation for these representatives is that of a certain fixed salary plus a commission, said commission based upon the revenue secured and the value of said revenue. It is recognized that a contract taken, bringing in a certain sum per year, where no expense for construction is necessary, is of greater value to the company than one where a sum equal to the amount received is to be spent for construction work, therefore the first mentioned contract should pay the representative a larger sum than the latter. In the selection of representatives it is wise to choose one having necessary qualifications of a power expert. Another should qualify as a sign, window and outlining expert. Another should possess special knowledge pertaining to illuminating engineering. Men thus equipped can assist the other representatives where special technical or expert knowledge is required. Where possible, it is wise for the representatives to be a combination of commercial and electrical engineers. The more knowledge the representatives possess along all lines the greater the efficiency.

An engineering department can render great assistance to the commercial department by aiding on all large installations of light and power. Their advice is also of value when working on isolated plants, and the two departments should work in unison, one with the other.

1, *Jour. Elec. Power and Gas.*

The salesroom should be planned to show all electrical devices and appliances, with the proper display of the various kinds of reflectors and glassware designed to properly reflect the light. The effect of decorative lighting should be incorporated; a full supply of staple and fancy electric fixtures should be shown; also different forms of display, window and sign lighting. Electric domestic and industrial appliances should form a permanent part of the office display. It might be advisable to have a line of electric motors, desk, ceiling and exhaust fans and various styles and forms of electric lamps. A dark room should be prepared for the display of electric lighting, for instance, as shown by reflectors, fixtures, etc.

The wiring and fixture department should be maintained by the company and should work in connection with the new business department. An arrangement of this character increases the efficiency and the value of the work done by the representatives.

The active officers of the company, the general manager, secretary-treasurer, superintendent, chief engineer, commercial manager, heads of important departments and one or two representatives, should meet at regular stated intervals for the purpose of discussing all new business matters. Suggestions for improvement or work of the department should be taken up and discussed, and it will be found that from the varied interests represented in this committee many new and original plans will be formulated. Furthermore, a spirit of harmony will be cultivated which will in turn be transmitted to all departments of the company, a most important factor in the conduct of new business work.

*Conduct.*—A daily morning meeting should be presided over by the business manager, at which time orders should be given and discussed, reports received from the representatives, giving a record of the previous day's work, preliminary reports presented, showing the nature of the proposed day's work. Matters of mutual interest discussed; verbal reports given by representatives, of interesting and important contracts closed; thorough discussions of same will result in creating and maintaining interest and enthusiasm. This meeting should be held for a period of one-half hour. It is the experience of representatives attending meetings, as above described, that the time thus spent is of a most profitable nature and the efficiency of their work has been increased.

Educational meetings should be held each week. Meetings might be presided over by a chairman and conducted along the lines of parliamentary law. Educational matters should be taken up and discussed, the meeting usually being held for a 2 hours' evening session. Papers of interest should be presented and discussed. Debates on pertinent subjects should occur. It might be of interest to have 2 representatives occasionally give an exhibition of how a sale should be made, 1 acting as salesman and the other as customer. It might be well to incorporate in this work some of the features found in the scientific study of salesmanship, a course of illuminating and electrical engineering and a thorough study of all principles involved in the supplying of electricity for light and power.

At the office or salesroom the various electrical appliances and devices should be carefully and thoroughly demonstrated. In fact, the last 2 or 3 days of each discount period it might be wise to arrange for a competent person to demonstrate electricity as applied to the various domestic uses, showing, among other interesting things, the chafing dish and various electrical cooking and heating appliances. Neighborhood demonstrations can profitably be given in consumers' homes, allowing the consumer to invite a few special friends, the company demonstrator cooking a meal and using exclusively electrical appliances. In this way very effective advertising may be accomplished.

Demonstration work can be carried a step further by showing at the office electric motors, fans, samples of signs, window lighting and outlining, and various other ways in which electricity is applied. Money spent in demonstration work usually proves very effective and is rarely wasted.

In organizing this department and carrying forward the work, it is found advisable to first make a house-to-house canvass, carefully carding all prospects, upon the completion of which the company possesses itemized and detailed information showing the amount of possible business to be secured. This information, when tabulated, will be found useful and valuable, and is of particular value when the electric company has competition, either in the form of another electric or gas company. When carded, the names and addresses appearing on said cards provide proper lists to be used in sending out advertising.

Representatives should not only be able to take orders, but possess the ability to sell goods. They should canvass all proposed extensions. One of the most important features of their work is the securing of additional consumption from present consumers. All complaint work

should be carefully followed up, and reports made to the office of all poor service, making sure that such service is remedied. Representatives play a most important part in popularizing the company and in the lessening of competition. It is important that they watch all new buildings, making sure that all electrical features are incorporated during their construction; that feeds are of sufficient size to take care of lighting other than the interior system; for instance, sign lighting, window lighting, display and outlining. They should visit architects and builders, interesting them in electricity for both domestic and industrial use.

The holding of business already secured is a most important feature of a representative's work. I deem it unwise to ever discontinue any business simply upon the request of a consumer. It will be found in many instances that much business can be held by a representative calling on the consumer. They can aid the advertising work by supplying the one having charge of the advertising with valuable and detailed information.

It is profitable to assign men to work exclusively upon increasing the consumption of present consumers, explaining to them and interesting them in the installation of additional domestic appliances; also decorative lighting and power.

The new business manager should have direct charge of the advertising, changing daily the ads appearing in the newspapers. He should select the souvenirs, possibly conferring with the representatives as to what they believe to be proper and effective ones.

A daily record should be compiled, by the office department, and given to the representatives, showing the appliances and orders taken and complaints registered. Thus he is enabled to keep in close touch with all business transpiring on his territory, whether of a personal nature or coming through the office.

Novel ways for applying electricity include its use for house cleaning, the mercury rectifier, electro-magnets for maturing coffee, electric machine for cutting dress patterns, arcs for promoting steady and rapid growths of vegetables, arcs over oil tanks for bug extermination, and arc and vacuum for taking and printing pictures.

The representative should occasionally go over his own business territory at night, thus determining where the dark spots are, and seeking to interest merchants in various forms of display lighting. Again, demonstrating to the merchant who has a dark store the value of his neighbors' brilliantly illuminated windows or stores. Representatives might occasionally go over their neighbors' territories at night, reporting at the next morning meeting suggestions whereby he would seek to improve the conditions found.

Results can and have been secured, more than compensating many companies for the money spent in the new business department. Specifically speaking, through this department, the consumption per kilo watt per inhabitant can be materially increased. This is true, also, of the consumption per consumer, and the consumption per 16-candle power lamp connected. This department is an important factor in reducing the manufacturing costs per kilowatt; also reducing the costs per kilowatt delivered to the consumers, which necessarily increases the company's profits. The department should be an important factor in increasing the daily load at all times except at the peak, thus lessening the amount of current losses, reducing the cost per kilowatt for manufacture and distribution, increasing relatively the profit.

It is further found that each prospect secured serves to assist in developing new ones. It will further be found that the field is inexhaustible. While in some instances the costs to secure new business the first year seem high, the fact must be taken into consideration that the business thus secured remains with the company for years, and is of no further cost. It is not an unusual thing for a new business department to receive in revenue, the first year, three or four times the original investment.

## The Latest Fuel Saving Fallacy.[1]

So-called fuel saving compounds are exploited in the daily press with increasing frequency. For years these mixtures have been brought out and their tests advertised, indicating wonderful economy by increasing the efficiency of the coal pile. But one after another they have dropped out of sight. Much has been written and printed lately concerning such a compound, consisting of oxalic acid, common salt, water and ashes. Some manufacturers and other owners of power plants have become interested, to the amusement or disgust of chemists and engineers. If this conpound is accomplishing what is claimed it would seem that perpetual motion, or its equivalent, has come at last. A compound almost devoid of carbon is introduced into coal, and more heat units are extracted than were put in. It does not seem to be a case of producing freer combustion, for the fuel is said to endure and to maintain a boiler pressure much longer than if coal were employed under ordinary conditions. It is not that a greater per cent. of heat units reach the engine in the form of steam, but that there are more heat units to be divided between waste and applied power.

Water, composed of hydrogen and oxygen, decomposes when subjected to sufficient heat, as when mingled with coal, and the hydrogen with the assistance of the oxygen will burn, giving out heat units. But even under theoretically perfect conditions the burning hydrogen will produce only as much heat as was required in the decomposition of the water. If 64,800 calories were demanded of the coal in separating the two gases then the hydrogen will in theory give out just 64,800 calories, though as a matter of practice there would be material loss in the retransformation.

Much the same general condition exists when the new compound is introduced into the fuel. Neither water nor common salt contains carbon. The ashes have a slight residue of unconsumed fuel; the remainder is unburnable mineral salts, no more valuable for fuel than the dust from a stone crusher. The percentage of carbon in oxalic acid is very slight. In one reported test, where steam is said to have been maintained in a boiler for several hours with an extremely small amount of fuel, plus the compound, the amount of carbon in the acid was no greater that that contained in a piece of coal the size of a chestnut. A very small percentage of the mixture was carbon. The fire must have converted the chemicals into gases, burned those which are inflammable and increased the number of heat units in the process, which, as in the case of the water, is impossible, a loss ensuing instead of a gain. It is stated that clinkers are consumed. The chemist answers, "What of it?" The amount of heat required to consume the carbon remaining in a clinker is greater than the heat given out by the clinker in the process of its combustion. One practical man who made a test of the compound under a power boiler states that his fire was slow in starting, then blazed hotly and brilliantly, and finally quickly died down. The clinkers seem to have burned, but the ashes were as much in evidence as ever. Under such conditions heat which should have been given out evenly through a given period may have been generated practically all at once. The fire had to use its energies in decomposing the chemicals; then the gases blazed fiercely, with highly colored effects from the sodium, and soon died away. Common salt added to a hot fire seems to burn freely; yet it adds no heat, but rather colors the flames.

Water may be employed with soft coal to excellent effect, it is claimed. Probably other non-carbonaceous additions to coal may have their purposes. But they do not add to the heat. Their function is other than what the parents of fuel compounds claim for the elements of their mixtures.

Several men of scientific reputation have publicly pointed out the fallacy of "discoveries" such as these. But the idea that the poisonous oxalic acid and its fellow ingredients will have important effects upon the world's fuel supply seems still to have sufficient vitality to keep up its newspaper travels.

1. *Iron Age.*

## An Accountant on Depreciation.[1]

At a recent meeting of the Chartered Accountant Students' Society of London, a lecture on "Depreciation, with Special Reference to the Accounts of Local Authorities," was delivered by Prof. Lawrence R. Dicksee, M.Com., F.C.A. The author has treated the subject purely from a scientific point of view.

At the outset, the lecturer directed the attention of his audience to the importance attaching to the subject, because while, on the one hand, the finances of local authorities are asserted to be in an "absolutely rotten" condition, on the other it has been urged that so long as the authorities comply with their statutory requirements, and set aside annually out of their revenue a certain amount to form a sinking fund to provide for the eventual repayment of their loan capital, they have done all that is necessary, and even more than is attempted in most proprietary businesses. He promised in his lecture to steer clear of both extremes, and to furnish some arguments in favor of the middle course which he thought should be pursued. He then proceeded to consider his subject, and began by explaining the term "depreciation" as meaning the loss or shrinkage in value that inevitably occurs from time to time in the assets which represent the capital equipment of a

1. *Journal of Gas Lighting.*

business, as a result of their employment therein; this loss being attributable to wear and tear, lapse of time, the march of modern invention, or to any or all of these causes combined. He pointed out that this shrinkage in value must be looked upon as a working expense of the business, in just the same way that the hire of the assets would have to be regarded if the use of them had merely been acquired for short periods, instead of capital having been expended in the acquisition of them. There are many different methods of computing the amount to be annually charged in the accounts, as depreciation, to cover this necessary and expected shrinkage in value. This is the ordinary and accepted view of depreciation as held by accountants and all business men who have come under their influence; but the lecturer said he did not think we ought for this reason to assume that it is a view which is necessarily enforceable against local authorities. At all events, no such assumption appears to be generally admitted; for many at least of those who claim to speak on behalf of these authorities urge that their constitution is such that they are not bound by rules and formulæ which it may be desirable, or even necessary, for ordinary individuals to observe. He therefore thought it advisable to endeavor, by inquiry into first principles, to arrive at some natural law which must admittedly be binding upon local authorities as much as upon proprietary undertakings.

Prof. Dicksee then went on to say that if we search for such a root principle as that to which he had referred, we shall find that it lies not very far from the idea which is at the back of every lawyer's head when considering questions of account, and which has so often proved incomprehensible to laymen—viz., that in its essence an account ought always to be capable of being resolved into a statement of receipts and payments in money, and would in all cases so resolve itself if we were content to wait for an account until the undertaking had been brought to an end. Regarded from this point of view, all payments are a charge against profits, and all receipts (other than those representing the original capital embarked in the undertaking, and any subsequent additions to it) are to be regarded as profits, which, after payment of the necessary disbursements, represent the net profit of the venture. If there were no necessity to prepare an account of profits until the undertaking had been completed and finally liquidated, this is the basis that we should doubtless all employ by preference; and it is only owing to the need—a need recognized by every business man—to be supplied with interim accounts at fairly frequent intervals, that we have evolved what may be called the "revenue basis" as opposed to the "cash basis" of accounts. In the preparation of a revenue account, designed to show the profits earned up to a particular date during the continuance of an undertaking, it is necessary to bear in mind, *inter alia*, that certain expenditure which will ultimately be chargeable against profits cannot for the time being be fairly so charged, because the full benefit of the expenditure has not been yet received, and further benefits may be reasonably expected to be received from the expenditure in subsequent years. Out of this circumstance has grown the practice of "capitalizing" certain expenditure which will result in benefits being continuously received over a considerable period of time. The lecturer considered the practice to be undoubtedly fair as between one year and another, and even necessary to enable one to arrive at a reasonable estimate of the profits up to date. But this interim estimate of profits is, in the nature of things, compiled upon the assumption that the benefits to be derived in the future from the expenditure which has been held in suspense (or capitalized) will be equal to the estimate we have formed of those benefits. To guard against serious errors of estimate under this heading, the Legislature has provided, in respect of certain classes of undertakings—railways and proprietary gas works, for example—that all expenditure upon the renewal of assets represented by expenditure that has been capitalized (or held in suspense) shall be charged against revenue; so that, at all events by the time an asset is discarded, a sum equal to its original cost, or the cost of replacing it by another asset equally efficient, shall be charged against revenue, and thus the proper charge shall be borne by the revenue of a series of years, even though there may be inequalities in the apportionment of the charge as between one year and another in the series. Bearing in mind the extreme difficulty of framing these estimates, this is probably as far as it would be practicable for the Legislature to go in such matters. At the same time it is clear that when the accounting parties desire to produce annual, or other short period accounts which will, as nearly as possible, show the true results of each period's working, it is frequently necessary to provide in advance something towards the cost of renewing assets, in order to avoid serious inequalities in the apparent profits shown by those accounts, which are represented by no corresponding fluctuations in the amount of profitable business actually done. In this way the custom has grown up among prudent business men of setting aside a provision for depreciation, which is the same thing as providing for the future cost of renewals, from the very first year in which the various capital assets are used, instead of waiting until such assets are discarded, and then charging a lump sum as representing the whole of the cost of such assets then written off against profits, in which event the whole of such cost of renewal would be charged against the profits of one year, though the benefit derived from their use had been received during many years.

Taking the principles he had enumerated as representing the basis upon which it is necessary that provision for depreciation of wasting assets should in all cases be provided, the lecturer thought he was on safe and uncontroversial ground, and might next proceed to consider the problem as applied to local authorities. This he did as follows: The trading departments of local authorities differ from ordinary business undertakings in this somewhat material respect, that the Legislature, having foreseen that the various assets they would acquire as a result of capital expenditure would, in the majority of cases, not last forever, but only for a limited number of years, has stipulated that the moneys borrowed to enable a local authority to pay for such assets must also only be borrowed for a certain limited number of years; and that during this period provision must be regularly made, by way of a sinking fund, to enable a sufficient amount of money to be set aside, and accumulated at compound interest, to redeem the loan on the date it becomes repayable. The effect of this stipulation, that there must be no permanent debt, is, of course, that, assuming the working life of the assets in all cases exactly corresponds with the period for which the loan has been granted, the amount set aside out of revenue during the time these assets have been available for use as revenue producers will exactly equal the whole of their cost. Consequently, though there may be minor errors with regard to the apportionment as between one year and another, the charge against revenue in respect of the sinking fund may, under these peculiar circumstances, be regarded as being the statutory equivalent for, and as taking the place of, the ordinary business man's charge for depreciation of assets. The sinking fund instalment, however, can only be regarded as equivalent to depreciation in those cases where the working life of each separate asset is exactly equal to the loan period.

The lecturer pointed out that this was a matter frequently lost sight of in practice, and was of the very greatest importance, as he next proceeded to show. He remarked that when a local authority apply for leave to issue a loan, they have to submit estimates of the proposed expenditure to the Local Government Board; and upon these being approved, the loan is sanctioned for a term which, in the opinion of the Board's officials, represents the average life of the assets that will be acquired out of the proceeds of the loan. Assuming that the loan period exactly equals the average life, it must be borne in mind that the various assets proposed to be acquired will, in all normal cases, be anything but uniform in character; and that thus there will be a very marked discrepancy between the loan period and the estimated life of almost each one of the several classes of assets proposed to be acquired, while, of course, there will be still further variations between individual items of assets of the same kind. In order to make this point quite clear, he submitted the following table, showing approximately how the expenditure on a municipal electric lighting works would probably be divided as between different classes of assets—the estimated working

| Class of Assets. | Estimated Life. Years. | Residual Value. Per Cent. | Effective Life. Years. | Amount of Expenditure. Per Cent. |
|---|---|---|---|---|
| Land | 100 | .. | 100.0 | 4.00 |
| Buildings | 80 | .. | 80.0 | 14.00 |
| Foundations | 100 | .. | 100.0 | 10.00 |
| Boilers | 25 | 5 | 26.3 | 5.50 |
| Dynamos | 30 | 8 | 32.3 | 6.00 |
| Engines and machinery | 25 | 6 | 26.6 | 21.50 |
| Cables | 35 | 15 | 41.2 | 32.00 |
| Arc lamps | 12 | 5 | 12.6 | 1.20 |
| Arc lamp posts | 40 | 5 | 42.1 | 1.00 |
| Accumulators | 15 | 10 | 16.6 | 0.20 |
| Motors | 25 | 9 | 27.5 | 0.55 |
| Office furniture | 15 | 5 | 15.5 | 0.30 |
| Meters | 12 | 2 | 12.3 | 3.40 |
| Accessories and instruments | 12 | 2 | 12.3 | 0.15 |
| Tools, etc. | 10 | 5 | 10.5 | 0.20 |
| | | | | 100.00 |

Average effective life 48.75 years.

life of each class of asset, its estimated residual value, and its effective working life, taking the residual value into account. From these particulars, it will be seen that the average effective life of the undertakings as a whole works out as nearly as possible at 48¾ years; and upon this basis a loan would in all probability be granted for 48 years, or thereabouts. But, upon comparing the loan period with the column showing the effective life of each class of asset, it will be found that in no single instance do the two correspond. In some cases the working life is very considerably greater, while in others it is very considerably less; and in no single instance is it even approximately the same.

Prof. Dicksee stated that the case shown in the table, while being comparatively simple, had not been so simplified as to represent a position of affairs differing very greatly from that which he had reason to believe generally obtains. He pointed out that the shortest lived asset on the list represented "Tools, etc.," which had an effective working life estimated at 10.5 years. It was true, he said, that this item represented only 0.2 per cent. of the capital expenditure, and that, therefore, any error that might be discovered in connection with it was practically a negligible quantity. But the general principle would apply equally well to all assets having an effective working life estimated at less than 48¾ years— that was to say, to the whole undertaking, with the exception of its lands, buildings and foundations. Dealing further with this item, he said: With regard to tools, the position is that at the end of about 10½ years, if our estimate of their working life proves true, they will require renewal. The cost of such renewal must to a large extent be then borne by revenue, because the rule of the Local Government Board is that whenever the renewal of an asset takes place, and provision has not been made for the repayment of the whole of the original cost thereof, a new loan will only be sanctioned to the extent to which provision has been actually made for such repayment. On the 2½ per cent. tables, a sinking fund of about 1 per cent. is necessary in order to provide for repayment at the end of 48¾ years, and at the end of 10 years that fund will only have amounted to 11.33 per cent. Therefore, upon the scrapping of these tools at the end of 10 years, 88.67 per cent. of the original cost must be charged against revenue. Now, it must, I think, be obvious that to charge 1 per cent. per annum for 10 years, and then about 89 per cent. in the 11th year, is not a fair or an equitable way of apportioning between those 11 years (or, to be accurate, 10½ years) the proper charge to represent the benefit derived by the undertaking during that period from the use of these particular assets. In this extreme case, it is clear that, in addition to the statutory sinking fund of 1 per cent. per annum, something like a further 8½ per cent. per annum ought to be charged as a reserve for renewals. Of course, in practice, it is not at all likely that all the tools will last for exactly the same period of time. Some may last more than 10½ years and some less; and yet 10½ years may represent the average life of this class of asset. * * * Conversely, those assets which have an effective life longer than the loan period will remain in good working order after the loan has been entirely repaid; and in the case cited it will be seen that the first three items have an average working life of 90 years, or nearly double the authorized loan period. When, therefore, a 1 per cent. sinking fund is set aside in respect of these items, it represents something like four times as much as is necessary to make due provision for depreciation. But this excess cannot be made use of to supply a deficiency, for the simple reason that the Local Government Board will not allow moneys to be borrowed for renewal purposes to an extent exceeding the provision made for the repayment of that portion of the loan.

Dealing further with the question of renewals, the lecturer said: We cannot even go the length of saying "It will be all right a hundred years hence," for in one way or another—that is to say, either in lump sum as renewals take place, or reasonably equitably apportioned over the various years, if due provision be made for the contingency in advance—the cost of those renewals for which no borrowing is permitted will have to be borne by revenue; and, inasmuch as there is a further rule that borrowing is not allowed (save within somewhat narrow limits) in respect of expenditure that has already been incurred, it is not even possible to get straight again later on, when the original loan period expires. Thus, in any event, the statutory sinking fund will not suffice to keep the undertaking going. Further charges must be made against revenue, as representing part of the cost of the renewal of what we may, for convenience, call the "short-lived" assets. Thus, in spite of its avowed policy to merely maintain the *status quo*, the Local Government Board in practice requires local authorities to accumulate a certain amount of capital on their own account. This is, and must in all cases be, the inevitable result of an equated loan period. That being so, the only prudent course, it seems to me, is for each local authority to have a careful calculation made, and as a result thereof to compute the annual sum they ought to charge against revenue, in addition to the sinking fund, in order to equalize the expenditure that will necessarily be incurred on the renewal of these "short-lived" assets. Such a charge is sanctioned by the statutory provision usually obtaining, permitting the local authority to create a reserve fund not exceeding (usually) one-tenth of their aggregate capital expenditure for the time being. This limit, though no doubt fixed without any previous scientific inquiry, will, I think, be found adequate under all normal circumstances. But the so-called reserve fund—or, as I prefer to call it, reserve (for renewals) fund—should be built up systematically upon a basis computed by careful calculation, and not haphazard out of "surplus profits" when there are any. Then, when the necessity arises for renewals to be made for which no borrowing is permissible, the cost of such renewals may be borne by the fund; thus reducing it, and permitting further accumulations to be made out of revenue from time to time. This plan has already been adopted at my suggestion by the Electric Lighting Department of one local authority, and its advantages are, I think, sufficiently evident to encourage the hope that others will gradually fall into line and adopt the same course. The advantages of so doing are, it seems to me, self evident. It effectually sets at rest all doubt as to whether due provision for depreciation is, in point of fact, being made; and, by so doing, naturally increases the credit of the local authority and improves the terms upon which they will be able to raise future loans. At the same time, by definitely ear marking from year to year gross profits which in all fairness ought to be set aside to provide for future expenditure, it becomes possible to provide reasonable reserve for contingencies; thus avoiding the fatal policy of reducing prices to a level which it will be impossible to maintain in future years, when heavy expenditure for renewals has to be provided out of revenue because no borrowing powers can be obtained.

Before leaving his subject, the lecturer pointed out that, with but very slight sacrifice at the present time, material advantages might be secured in the future by gradually reducing the outstanding indebtedness of the various trading departments. In the present state of the law, the maximum reserve fund is usually 10 per cent. upon the capital expenditure; and this would probably be held to include the reserve necessary to equalize expenditure upon renewals. But, were this maximum to be abolished, an additional sinking fund of ¼ per cent. per annum would entirely free an undertaking from debt in about 69 years; while a sinking fund of only 4s. per cent. per annum would produce the same effect in less than 100 years. Thus, at an almost imperceptible increase of current expenses, provision might be made for a material reduction in the indebtedness of local authorities at no very far distant date; and he could not help thinking that the increased charge upon the present generation of ratepayers would be almost immediately compensated for—and even more—by the more favorable terms on which local authorities would then be able to issue their loans. The mere fact that local indebtedness was decreasing, instead of growing, would greatly increase the competition for local stocks, and thus enable them to be issued at a higher price or at a lower rate of interest, or perhaps at both—a result which would very speedily compensate for an immediate expenditure of a few shillings per cent. per annum on the present amount of indebtedness.

Prof. Dicksee remarked that this was, of course, outside the scope of his subject, and represented merely what might be done if the Legislature thought fit to extend the powers it now grants to local authorities; but as a problem in practical finance, it presented points of considerable interest, and was thus, he thought, well worthy of more careful consideration than it appeared at the present time to have received.

## High Pressure Gas Lighting in Schools.

In a paper on the use of high pressure gas for the lighting of schoolrooms, read by Dr. P. Schumann, of Munich, before the last meeting of the Bavarian Association of Gas and Water Engineers, the author described the preliminary experiments which were made upon the lighting of a schoolroom in a large educational institution by the authorities of the Municipal Gas Works at Munich, which experiments were so successful that a permanent installation of the same kind was erected to serve the greater part of the building, and it has been in operation ever since October, 1905. The school where the experiments were carried out contains a considerable number of rooms of different sizes. The theater has been fitted with electric arc light, as the latter is said to be somewhat more convenient than gas for optical lantern work. Else

where in the building gas is employed, 140 ordinary incandescent burners being used in some of the rooms, more particularly for the illumination of the students' tables, while the rest of the building has been provided with 134 high pressure "Millennium" burners. The plant for the compression of the gas is erected in the cellar. The gas passes through two 200-light meters, arranged in parallel, into two compressors driven by electric motors of ¾-horse power and 1½-horse power respectively. The whole plant is capable of supplying about 2,200 cubic feet of gas per hour at a pressure of 52,4 inches of water.

When the initial experiments were commenced it was taken for granted that an illumination equal to 3.4 candle feet on the writing tables would be sufficient; and it was decided to adopt an indirect system of lighting, though tests were to be made in order to see whether the advantage lay with purely indirect or with partially indirect light. The room selected for the tests had a floor surface of 830 square feet, and was approximately 12 feet 6 inches high. In this room, 6 No. 200 "Millennium" lights were so slung that the upper surface of the reflectors was 4 feet from the ceiling. The lamps are so distributed that the distance between them was, as nearly as possible, twice that of each from the nearest wall. They consumed 8.66 cubic feet of gas per hour, measured before compression. The room was freshly whitewashed and emptied of furniture before the measurements of illumination were made, and the windows were coated with white paper. When the mantles had burnt for about 10 hours the illumination was measured at 12 spots 3 feet above the floor—some positions being immediately under the lamps and others midway between them. Measurements were carried out under 4 different conditions: (I.) When the light was purely indirect—*i e.*, the reflectors of the lamps were sheet metal painted white on the inner side; (II.) when the light was to some extent direct (*a*) the reflectors being composed of 4/4 flashed glass, (*b*) of 6/4 flashed glass, and (*c*) of ordinary opal glass. Expressed in candle feet, the figures obtained were as follows:

| | I. | II. (*a.*) | II. (*b.*) | II. (*c.*) |
|---|---|---|---|---|
| Average..... | 6.20 | 8.45 | 7.80 | 7.8 |
| Maximum..... | 6.76 | 9.90 | 8.96 | 8.8 |
| Minimum..... | 5.32 | 6 84 | 6.68 | 7.0 |

The results show that the suggested illumination of 3.4-candle feet was exceeded in every position, so that a smaller number of lamps might have been used. They also show that, for a given amount of candle power developed, the illumination was less uniform when the light was entirely indirect than when it was partially direct. The mean illumination was roughly 28.5 per cent. higher when 4/4 flashed glass was used, and 21.5 per cent. higher when 6/4 per cent. flashed glass was used than when the reflectors were opaque. The general effect was in all cases excellent, being at its best with the thicker flashed glass and the opal glass. The thinner flashed glass allowed the mantles to be visible and gave them a reddish color. The darkness of the metallic reflectors produced a disagreeable effect.

In consequence of the success of these experiments the main installation was then proceeded with, and it was decided to adopt 6/4 flashed glass for the reflectors of the lamps. According to the size of the rooms, they were providld with 4 or 5 lamps, and in each room 2 outlet ventilators, 18 inches by 20 inches in size, were fixed in the ceilings, and they were found to keep the atmosphere in a perfectly agreeable condition. When the burners had been in use for nearly 3 months they were reported to give every satisfaction except in a few rooms, where a falling off in the illumination was apparent. The defect was clearly due to two causes—first, that the regulating collars of the inlets for primary air were apt to slip round, thus reducing the quantity of air admitted and diminishing the illuminating power of the burners; secondly, that some of the mantles employed had been of inferior quality. It was, therefore, decided to change the make of mantle and to use larger burners (No. 300), which consumed 14.1 cubic feet of gas per hour, as measured before compression. In these new conditions measurements of the illumination were made in 14 or 15 different positions in 2 rooms, the smaller of which was provided with 4 lamps and had a floor surface of 660 square feet, while the larger was provided with 5 lamps and had a floor surface of 830 square feet as before. In the smaller room the illumination values in candle feet measured upon the working tables were: Average, 9.45; maximum, 11.15; minimum, 8. In the large room they were: Average, 9.7; maximum, 11.1; minimum, 7.8.

The new arrangement was entirely satisfactory, and even if one or other of the lights happened to be burning badly, the average illumination upon the benches did not fall below 6 or 7 candle feet. It was, however, found that the lamps required a considerable amount of attention if the illumination was to be kept uniform. When in regular use, the reflectors and the burners needed cleaning every 2 or 3 weeks; and it was necessary that the mantles should be renewed with sufficient frequency. The average lifetime of the mantles on the high pressure gas burners was 150 hours. The last mentioned figures indicate that in a room 12 feet 6 inches high, when due allowance is made for the diminution in illuminating power of the mantles, a mean illumination equal to 6.8 candle feet can be obtained from the combustion of 6.85 cubic feet of gas per 100 square feet of floor surface; whereas the experiments carried out by the Committee of the German Association of Gas and Water Engineers, upon purely indirect lighting in a room 13 feet high, gave the corresponding consumption of gas to be 8.17 cubic feet. The author therefore considers that a suitably arranged installation of high pressure gas lighting is well adapted for school buildings. The best system of illumination, in his opinion, is one of semi-indirect light.

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Laclede Firebrick Company informs us that it has been awarded the contract for the bench work at the new gas plants to be constructed in Beardstown, Ills., and Cleburne, Tex. During the past 5 weeks the Company has received orders for an 11-foot set of linings, complete, for St. Paul, Minn.; a 5 foot 6-inch lining for East St. Louis, Ills., and linings for Doe Run and St. Joseph, Mo., and Palestine, Tex.

THE laborers in the gas works at Vienna, Austria, have struck for higher wages. They are now being paid at the rate of 60 cents per day, and their demand is equivalent to 66 cents per day.

MR. JAMES FERRIER, President of the Rome (Ga.) Municipal Gas Company, informs us that Mr. J. L. Wyatt, Secretary of the Company, died at his home in Chattanooga, Tenn., the morning of the 8th inst. Deceased, who was in his 53d year, had been a great sufferer from a complication of diseases since last fall. As Mr. Ferrier, in informing us of Mr. Wyatt's death, says, "He will be greatly missed by many a gas manager, more especially by those who reside in the Dixie States."

MESSRS. A. A. KIND and associates, of Jacksonville, Fla., have secured the right to build and operate a gas and electric lighting plant in Green Cove Springs, Fla.

SECRETARY GLENN R. CHAMBERLAIN, the efficient and up-to-date gentleman who has charge of the commercial department of the Grand Rapids (Mich.) Gas Light Company, entertained a score of his corps the other evening at dinner in the Pantlind Hotel. The main thing for the consideratiou of those who shared in the feast was "how best to land hard customers." The plates, however, seemed to show that the food was worth putting away.

AT the annual meeting of the Sandusky (O.) Gas and Electric Company the following officers were elected: Directors, B. Mahler, C. B. Wilcox, E. W. Moore, A. Lowenthal, T. W. Coen and M. M. Wiener; President, B. Mahler; Vice-President, C. B. Wilcox; Secretary and Treasurer, F. W. Coen; Manager, E. A. Beckstein.

TO-DAY, Mr. E. A. Snead, President of the Town Council of Clifton Forge, Va., will open bids for the purchase of a franchise granting permission for the construction, maintenance and operation of a gas manufacturing plant for a period of 30 years in Clifton Forge.

EARLY this month a stroke of lightning badly damaged the plant of the Temple (Tex.) Gas Company. The loss occasioned amounts to $7,500, or more.

MR. GEORGE BULLOCK has been elected President of the Lancaster (Pa.) County Railway and Light Company, vice Mr. W. W. Griest.

UNDER the contract for the public lighting of Hempstead, L. I., recently awarded the Nassau and Suffolk Lighting Company, that handsome, old-time village of Long Island, which is now taking on semi-metropolitan airs, the streets are really well illuminated, in fact better than they ever were before. Welsbach improved lamps are used.

THE De Pere (Wis.) Electric Light and Power Company has arranged for the construction of a gas works.

THE Hudson River Power Company has filed an application with the State Commission of Gas and Electricity for the right to issue a consolidated and refunding mortgage amounting to $3,323,000.

THE City Council of Stockton, Cal., has named the following as the rates that are hereafter to apply for a lighting and heating service in that city: Artificial gas, $1.25 per 1,000 cubic feet; natural gas, 90 cents. Electricity, 7 cents per kilowatt. Minimum rate for meter per month, $1.50.

IF the plans underway are carried out, in due time the generating capacity of the Glen Falls (N. Y.) Gas and Electric Light Company will be increased to 300,000 cubic feet per day, from 150,000 cubic feet.

MR. MCDONALD, of the Evansville (Ind.) Gas and Electric Company, has bid for a leasehold of the Henderson (Ky.) Municipal Gas Works, and is likely to be successful in his quest.

A CORRESPONDENT in Los Angeles, Cal., writing under date of the 5 h inst., incloses the following: "The Los Angeles Gas and Electric Company has brought suit in the Superior Court against the Amalgamated Oil Company, in which breach of contract is alleged, and damages in the sum of $18,000 are asked for. The defendant, under the petition, it is said was under contract to furnish the plaintiff a sufficient quantity of oil to operate all the Company's plants. Later this contract was transferred to the Amalgmated Oil Company, which agreed to carry out the provisions of the original contract. According to the provisions of the contract the Gas Company was to receive, delivered, 42 gallons of oil for 45 cents. The contractor failed to supply the necessary oil, it is alleged, which cost the Company $18,000 more for its oil."

THAT net reduction of 10 cents per 1,000 cubic feet, ordered by the Rockland County (N. Y.) Light and Power Company, on all gas supplied by it, will date effectively from the 1st inst.

MR. BEMENT LYMAN, former Secretary of the Consumers Gas Trust Company, of Indianapolis, Ind., has been elected Secretary of the Indiana Trust Company.

OPPOSITION to the Cape Ann Gas Company, which proposes to lay pipes in certain streets of the 6th and 7th wards of Gloucester, Mass., is being opposed (naturally and properly) by the Gloucester Gas Company.

THE Finance Committee of the Hartford Legislature has reported adversely on the application of the Willimantic Gas and Electric Light Company for the right to issue $100,000 debenture bonds.

A CORRESPONDENT in Columbus, O., forwards the following: "A decision handed down in the Supreme Court in the case of the City of Columbus against the Columbus Gas and Fuel Company, to oblige it to pay a franchise tax amounting to the sum of $4,000 annually, caused some surprise, in that it reversed former ratings in the case, which favored the contention that the tax was exorbitant and unlawfully levied."

WE are indebted to "T. R. M." for the following: "The De Pere (Wis.) City Council has adopted the ordinance granting to the De Pere Electric Light and Power Company a franchise for the erection of a gas plant. As adopted the franchise permits the Company to allow a discount of 10 per cent. for payment at the office before the 10th of every month. The Company is given 2 years from the adoption of the franchise to begin work, and the plant must be completed and in operation within 3 years. If accepted by the Company, it is thought that work on the construction of the plant will begin next spring. It is not thought possible to begin work this year because of time required to secure necessary material, especially iron pipe. The maximum price for gas for light or power, under the terms of the franchise, will be $1.50 per 1,000 feet, with a cash discount of 10 per cent. for bills paid before the 10th of the succeeding month, making a net rate of $1.35 per 1,000 feet. If at any time the net profits of said gas plant shall exceed 7 per cent. per annum on the total amount invested in the construction of the plant, the Company agrees to furnish gas to the city of De Pere and the citizens thereof at a less proportionate rate. At the expiration of the term of the franchise and at the end of every 5 years thereafter, the city shall have the option of purchase at an appraised value by disinterested parties. The franchise is for the term of 40 years, of which 15 is to be exclusive to the De Pere Electric Light and Power Company."

HERE is something relative to the success that is being the portion of the Calumet (Mich.) Gas Company: "Realizing that the low pressure system is inadequate to the proper supply of gas to the residents of the Red Jacket District, Superintendent Sloane has been authorized to have a high pressure system installed. This will involve a period of 3 weeks, but will at no time seriously interfere with the consumption of gas at any point. When the change is made it will be at such an hour that as few people as possible will be inconvenienced. Supt. Sloane has already started the work on changing from the low to the high pressure system and there is not a question but that it will give Red Jacket as fine a gas supply as could be desired. Right now the gas supplied to the villagers is hardly up to the mark, but the officials have no doubt that within the next 3 weeks it will be possible to have the new system in operation, and that until that time there can be but little better service expected in Red Jacket. The proprietors are more than pleased with the patronage which has already been accorded the Company. Though it has been operating for less than 4 weeks now it has several hundred patrons on its list. Itwas expected that from the start that the number of people who would use gas for lighting purposes would be few, but it develops that scores of business places are burning the illuminant and are receiving excellent satisfaction. Red Jacket people are using gas almost entirely for cooking purposes, although the pressure for illuminating is yet hardly satisfactory. Several gangs of men are busily engaged continually in making connections with the gas mains and are adding to the list of patrons of the Company. A fortnight ago there was started in the Laurium office of the Company a series of demonstrations of baking by means of gas. Mrs. Martha Stone, an expert in this line, was there several days showing the ladies and others interested in cooking and baking by gas the best means of so doing. It is expected that Mrs. Stone will give similar demonstrations in Red Jacket as soon as she completes her Laurium engagement."

THE New Bedford (Mass.) Gas and Edison Light Company is preparing, in fact, has arranged for notable main extensions, which involve an expenditure going into the thousands.

THE general bill to permit cities and towns of Illinois to operate gas and electric lighting works on municipal account has been defeated.

THE Waukesha (Wis.) Gas and Electric Company will install a central plant for house heating.

THE special election which was called to determine whether or not the authorities of Paulsboro, N. J., should establish a gas plant there has been put over to the 11th prox. There can be no doubt about it that the authorities mean business in connection with this project.

AT the annual meeting of the Petersburg (Va.) Gas Light Company no change was made in the official direction thereof.

A LIKE remark applies to the annual meetings of the Scranton (Pa.) Gas and Water Company and of the Hyde Park Gas Company. That Nestor of the gas business, Mr. W. W. Scranton, is certainly a remarkable man.

THE Milwaukee (Wis.) daily papers have reported the findings in the case of Patrick Young against the Milwaukee Gas Light Company, who sued for $10,000 and was awarded a verdict in the sum of $3,000. Plaintiff was injured by the fall of a derrick, while in the service of the defendant, the afternoon of November 9th, 1904. The jury accompanied their verdict with the statement that the foreman in charge of the crew, of which plaintiff was a member, was incompetent, that the corporation knew of his incompetency, and that ordinary care was not used in the erection of the derrick.

A BILL extending the gas regulator act, which has applied to Chicago since 1905, has been amended to be effective all over the State. It has passed the House, but there is not much likelihood that the Senate will indorse the scheme.

THE Peoria (Ills.) Gas and Electric Company is extending its main system to and through the outlying district of Richmonds township. It will also make other extensions.

THE AMERICAN GAS LIGHT JOURNAL

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PROPRIETORS.

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MONDAY, MAY 20, 1907.

## The Market for Gas Securities.

Dullness ruled the market for city gas shares last week, but the persistent inquiry for gas bonds at better figures than those named since last January would seem to indicate that investors are satisfied with the situation. The decision on the merits of the 80-cent rate in this city may be received before June 15th, and it would not be in any sense surprising if the judgment were in favor of the Company.

Brooklyn Union is weaker nominally, whereas the indications are that the opposite state should prevail. We think it likely that a dividend of some sort will be made before long; at any rate one should be paid, for the Company is in good financial position. Peoples, of Chicago, is 91½ to 92. Rumor has it that the Washington (D. C.) melon ground is about to produce further fruit.

## Gas Stocks.

**Quotations by George W. Close, Broker and Dealer in Gas Stocks.**

16 WALL STREET, NEW YORK CITY.

MAY 20.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

| *N. Y. City Companies* | *Capital.* | *Par.* | *Bid.* | *Asked.* |
|---|---|---|---|---|
| Consolidated | $73,177,000 | 100 | 132 | 134 |
| Central Union Gas Co.— | | | | |
| 1st 5's, due 1972, J. & J. | 3,000,000 | 1,000 | 101 | 104 |
| Equitable Gas Light Co.— | | | | |
| Con. 5's, due 1932, M. & S. | 1,000,000 | 1,000 | .. | 105 |
| Mutual | 3,500,000 | 100 | 190 | 225 |
| New Amsterdam Gas Co.— | | | | |
| 1st Con. 5's, due 1948, J. & J. | 11,000,000 | 1,000 | 98 | 100 |
| New York & Richmond Gas Co. (Staten Island) | 1,500,000 | 100 | 37 | 43 |
| 1st Mtg. Gold Bds. 5 p.ct. | 1,000,000 | .. | 98 | 104 |
| Northern Union— | | | | |
| 1st 5's, due 1927, J. & J. | 1,250,000 | 1,000 | 101 | 103 |
| New York and East River— | | | | |
| 1st 5's, due 1944, J. & J. | 3,500,000 | 1,000 | 108 | 111 |
| Con. 5's, due 1945, J. & J. | 1,500,000 | .. | 104 | 110 |
| Standard | 5,000,000 | 100 | 140 | 160 |
| Preferred | 5,000,000 | 100 | 155 | 175 |
| 1st Mtg. 5's, due 1930, M. & N | 1,500,000 | 1,000 | 104 | 108 |
| The Brooklyn Union | 15,000,000 | 1,000 | 112 | 120 |
| 1st Con. 5's, due 1948, M. & N | 15,000,000 | | 107 | .. |
| Yonkers | 999,850 | 500 | 120 | .. |
| *Out-of-Town Companies.* | | | | |
| Bay State | 50,000,000 | 50 | ¼ | ⅝ |
| " Income Bonds | 2,000,000 | 1,000 | .. | 75 |
| Binghamton Gas Works | 450,000 | 100 | .. | 65 |
| " 1st Mtg. 5's | 500,000 | 1,000 | 95 | 100 |
| Boston United Gas Co.— | | | | |
| 1st Series S. F. Trust | 7,000,000 | 1,000 | 52 | 55 |
| 2d " " " | 3,000,000 | 1,000 | 47½ | 50 |
| Buffalo City Gas Co. | 5,500,000 | 100 | 9 | 10 |
| " " Bonds, 5's | 5,250,000 | 1,000 | 75 | 80 |
| Capital, Sacramento | 500,000 | 50 | .. | 25 |
| Bonds (6's) | 150,000 | 1,000 | .. | .. |
| Chicago Gas Co. Guaranteed Gold Bonds | 7,650,000 | 1,000 | 104 | 106¾ |
| Cincinnati Gas and Electric Co. | 29,500,000 | 100 | 98 | 98¼ |
| Columbus (O.) Gas Co., 1st Mortgage Bonds | 1,500,000 | 1,000 | 90 | .. |
| Columbus (O.) Gas Lt. & Heating Co | 1,682,750 | 100 | 87 | 88 |
| Preferred | 3,026,500 | 100 | 107½ | 108 |
| Consumers, Toronto | 2,000,000 | 50 | 200 | 204 |
| Consolidated, Baltimore | 11,000,000 | 100 | . | 90 |
| Mortgage, 6's | 3,600,000 | .. | .. | 115 |
| Chesapeake, 1st 6's | 1,000,000 | .. | .. | .. |
| Equitable, 1st 6's | 910,000 | .. | .. | .. |
| Consolidated, 1st 5's | 1,490 000 | .. | .. | 112 |
| Consolidated Gas Co. of N.J. | 1,000,000 | 100 | 15 | 17 |
| Con. Mtg. 5's | 880,000 | 1,000 | 92 | 95 |
| Bonds | 75,000 | .. | .. | 100 |
| Detroit City Gas Co | 5,000,000 | 50 | .. | 50 |
| " Prior Lien 5's | 4,618,000 | 1,000 | .. | 98 |
| Detroit Gas Co., 5's | 381,000 | 1,000 | 75 | 80 |
| " Inc. 5's | 15,000 | 100 | 98½ | 100 |
| Equitable Gas & Fuel Co., Chicago, Bonds | 2,000,000 | 1,000 | .. | 101 |
| Essex and Hudson Gas Co. | 6,500,000 | .. | 39 | 40 |
| Fort Wayne | 2,000,000 | .. | .. | .. |
| " Bonds | 2,000,000 | .. | 55 | .. |
| Grand Rapids Gas Lt. Co. 1st Mtg. 5's | 1,325,500 | 1,000 | 104½ | 105 |
| Hartford | 750,000 | 25 | 190 | 200 |
| Hudson County Gas Co., of New Jersey | 10,500,000 | .. | 110 | 112 |
| Bonds, 5's | 10,500,000 | .. | 107½ | 108½ |
| Indianapolis | 2,000,000 | .. | 60 | 70 |
| " Bonds, 5's | 2,650,000 | .. | 104½ | 105 |
| Jackson Gas Co | 250,000 | 50 | 82 | .. |
| " 1st Mtg. 5's | 990,000 | 1,000 | 97 | 100 |
| Kansas City Gas Light Co., of Missouri | 5,000,000 | 100 | .. | 86 |
| Bonds, 1st 5's | 3,822,000 | 1,000 | 102 | 104 |
| Laclede, St. Louis | 10,000,000 | 100 | .. | 05 |
| Preferred | 2,500,000 | 100 | 95 | 110 |
| Bonds | 10,000,000 | 1,000 | 104 | 104¼ |
| Lafayette Gas Co., Ind | 1,000,000 | 100 | .. | 60 |
| Bonds | 1,000,000 | 1,000 | 60 | 65 |
| Louisville | 3,570,000 | 50 | 143 | 145 |
| Madison Gas & Elec. Co. | | | | |
| " 1st Mtg. 6's | 350,000 | 1,000 | 106 | 108¾ |
| " 6 per cent. scrip, due 1910 | 100,000 | 25 | 85 | 87 |
| Massachusetts Gas Companies of Boston | 25,000,000 | 100 | 62¾ | 63 |
| Preferred | 25,000,000 | 100 | 84½ | 84¾ |
| Montreal, Canada | 2,000,000 | 100 | 215 | 218¾ |
| Nashville Gas Lt. Co. | 1,000,000 | 100 | 110 | .. |
| Newark, N. J., Con. Gas Co. | 6,000,000 | .. | 56 | 58 |
| Bonds, 6's | 6,000,000 | .. | 137 | 138 |
| New Haven | 2,000,000 | 25 | 200 | .. |
| Peoples G. L. & Coke Co., of Chicago | 25,000,000 | 100 | 91½ | 92 |
| Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage | 20,100,000 | 1,000 | .. | .. |
| " 2d " | 2,500,000 | 1,000 | 104 | .. |
| Rochester Gas & Elec. Co. | 2,150,000 | 50 | 85 | .. |
| Preferred | 2,150,000 | 50 | 118 | .. |
| Consolidated 5's | 2,000,000 | .. | 104½ | 105¼ |
| San Francisco, Cal. | 15,800,000 | 100 | .. | .. |
| St. Joseph Gas Co. 1st Mtg. 5's | 751,000 | 1,000 | 92 | .. |
| St. Paul Gas Light Co | 1,500,000 | 100 | 45 | 47 |
| 1st Mortgage 6's | 850,000 | 1,000 | 113 | 116 |
| Extension, 6's | 600,000 | 1,000 | 112½ | 115 |
| General Mortgage, 5's | 2,465,000 | 1,000 | 96¼ | .. |
| Syracuse, N. Y. | 1,975,000 | 100 | 50 | 55 |
| Bonds | 2,047 000 | 1,000 | 102 | .. |
| Washington, D. C | 2,500,000 | 20 | 300 | 305 |
| First mortgage 6's | 600,000 | .. | .. | .. |
| Western, Milwaukee | 4,000,000 | .. | .. | .. |
| Wilmington, Del. | 600.000 | 50 | 230 | .. |

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## PROPOSALS

Will be received for complete coal or water gas plant of 50,000 cu. ft. daily minimum and 100,000 maximum capacity. High pressure system. Ten miles mains. Prices wanted on parts separately and for the complete installation. Also quotations on stoves, meters, governors, piping, fixtures, etc., in lots of 500 or over. Address, JOSEPH L. DUNN & CO.,
1637-t 54 Public Square, Wilkes-Barre, Pa.

Estimates furnished for the erection of complete gas works or the extension and modernizing of old works. All work warranted. Both water gas and coal gas.
EMPIRE GAS IMPROVEMENT & CONSTRUCTION COMPANY,
1628-tf 49 Wall Street, New York

## Situation Wanted.

Young man, 30 years of age, and of 12 years' practical experience in gas manufacture and distribution, wishes situation as engineer or superintendent of a gas company where expert services are required and the output is at least 50,000 per day. Is graduate engineer and at present superintendent of one of the largest high pressure plants in the U. S. The best of references and experience only.
1666-2 Address, "S. R. U.," care this Journal.

## Position Wanted.

**A Capable Manager and Superintendent,**

Now employed, desires a position as manager or superintendent of gas, or combined gas and electric plants, in city of 15,000 to 25,000 population. Successful record. Southern or Middle States location preferred.

Address, "P. T. A.,"
1641-tf Care this Journal.

## WANTED,

**Position as Superintendent of Gas Company,**

By young married man of 16 years' experience in all its branches. Is now superintendent of gas company of 30,000,000 cubic feet. Will have to give present company 60 days' notice. Best of references.
1652-tf Address, "CAPABLE," care this Journal.

## Position Wanted

**As Water Gas Superintendent.**

One that can get results wishes to change location. Highest references.
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Gas engineer, with some electrical experience, desires connection with company operating gas or combined plants. At liberty June 1st. Address, "A. B.,"
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Delivering under both high and low pressure. Must be familiar with Westinghouse compressors and pumps necessary in plant of this character. Two benches inclined 4's now working. Write for further information and terms. References required.

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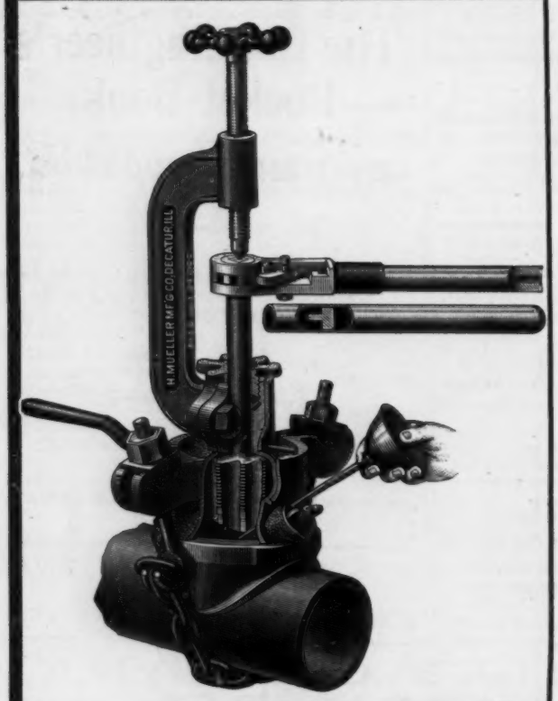


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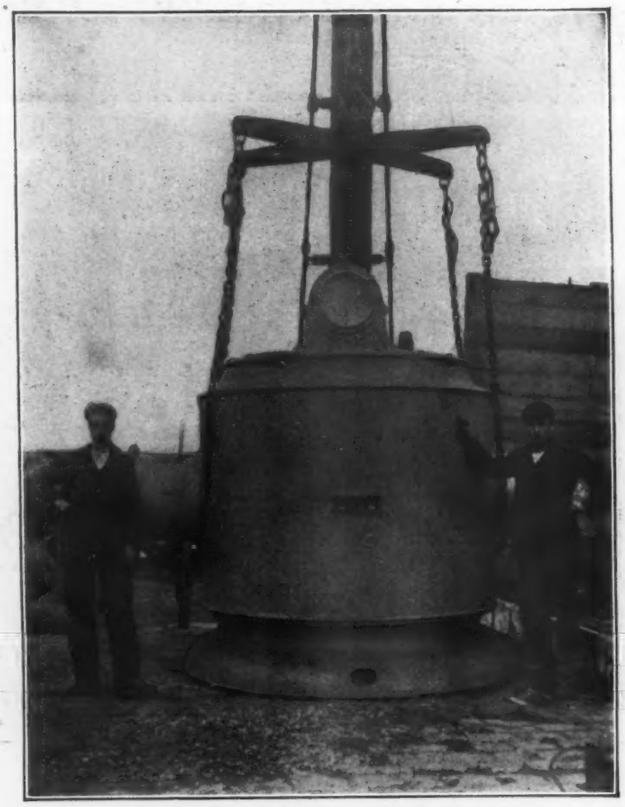

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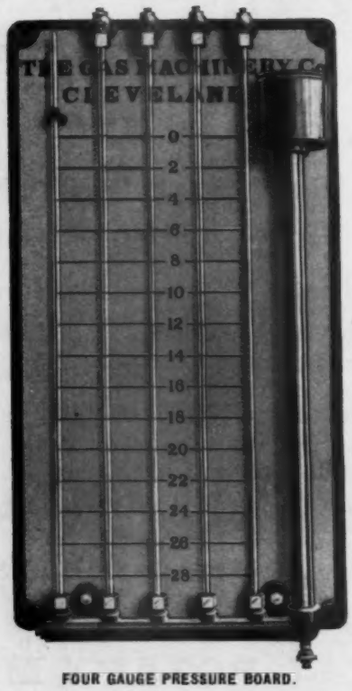


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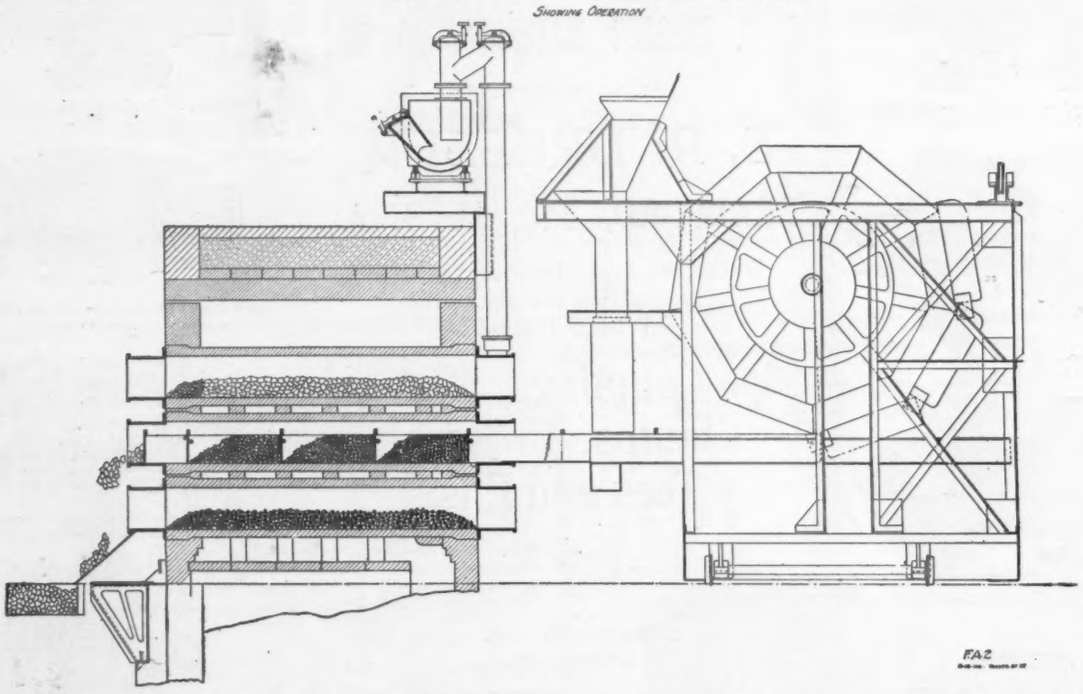

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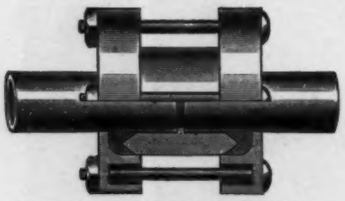
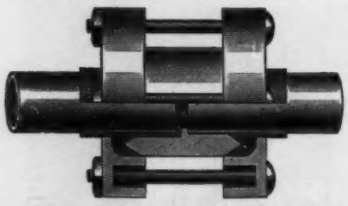
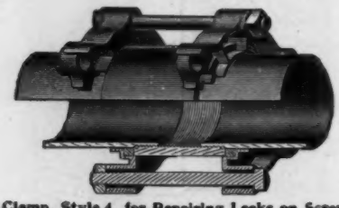
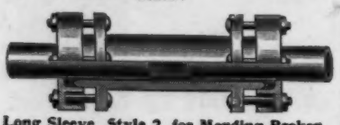

Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.


Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe.


Clamp, Style 4, for Repairing Leaks on Screw Collar.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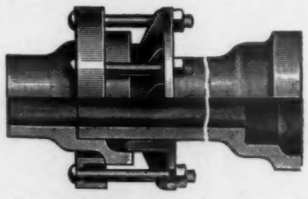
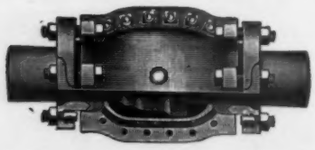
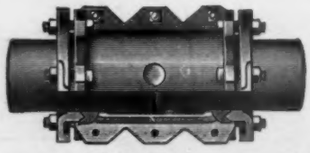
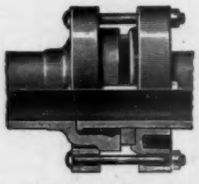

Coupling, Style 9, for Special Style Cast Iron Pipe.


Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.


Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.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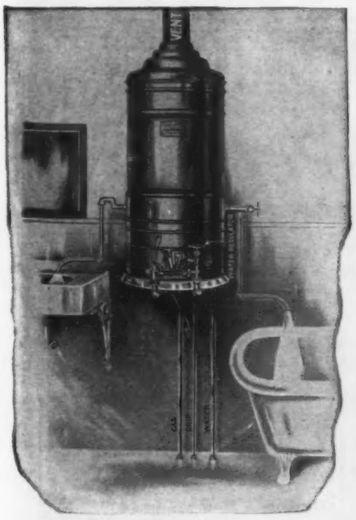

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| 6 | 29.00 | ¾ " | 3 | 29¼ | 12 | 60 " |
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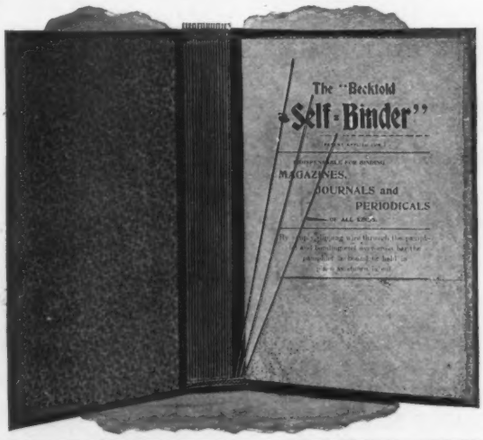


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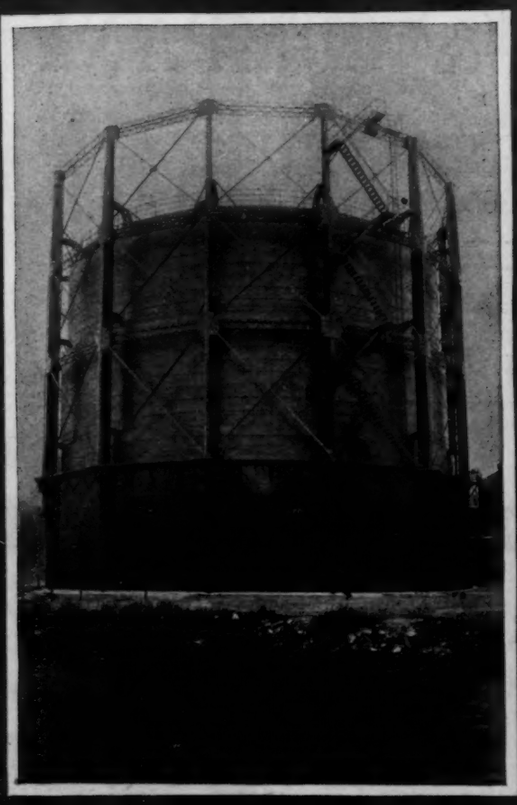

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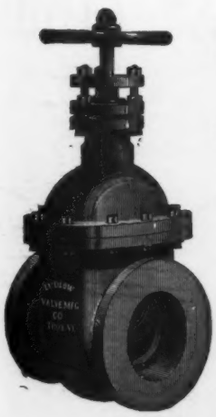

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Double and Single Gate Valves, ¼" to 72",

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**Bristol's Recording Pressure Gauges**

—(ALL RANGES).—

Used the World Over.

Necessary Equipment

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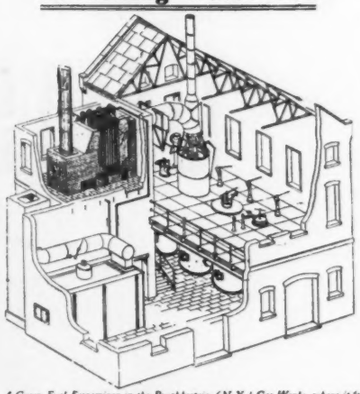
**How to Save 15% of the Coal in Making Water Gas**



*A Green Fuel Economizer in the Poughkeepsie, (N. Y.) Gas Works, where it is Saving 25% of the Boiler Fuel. The Green Air Heater is Installed in the Same Manner as the Economizer and will save 15% of the Generator Coal.*

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Also Builders of Fans, Blowers and Exhausters

**SEND FOR THIS PAMPHLET.**

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PATENTED MAY 13, 1902.
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**NO DUMPING OF METERS TO GET THE WATER OUT.**

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Maximum Efficiency,
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***Stand so High in the estimation of those using them?***

THE ANSWER IS IN THREE WORDS:

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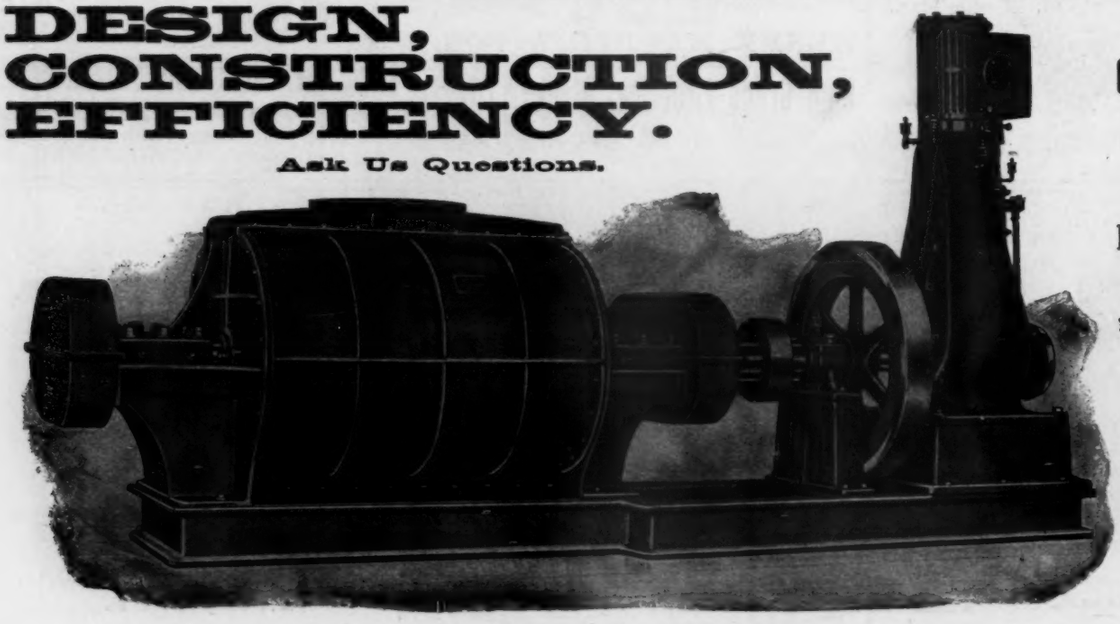

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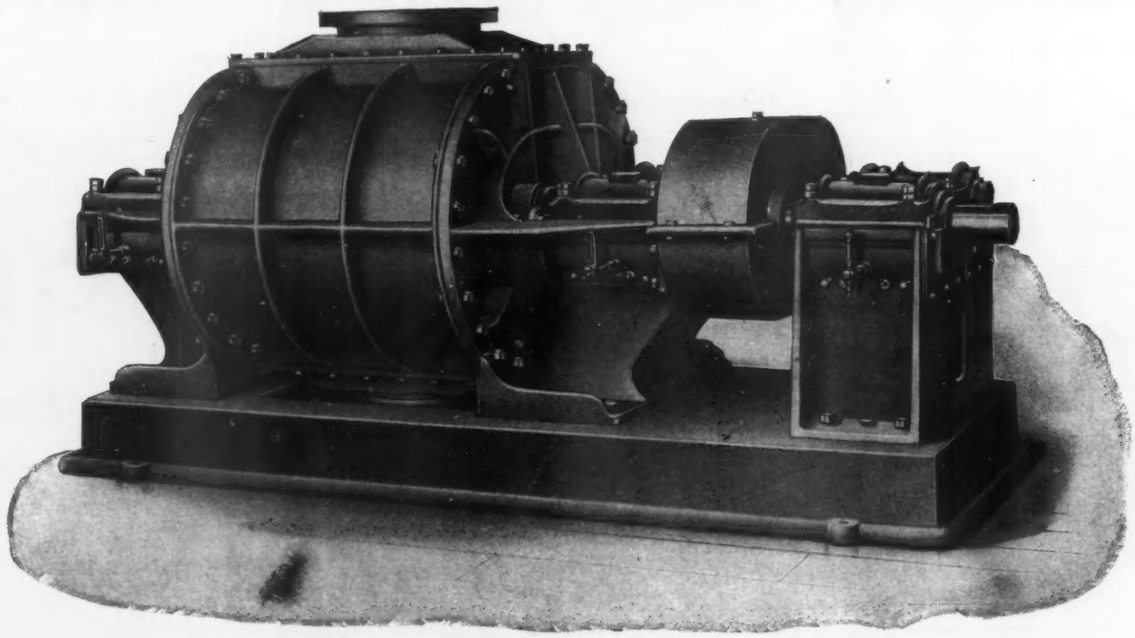
The highest efficiencies obtained. Most perfect devices for adjustment and maintenance of proper alignment. Use our flexible coupling to correct troubles caused by misalignment and engine shaft thrust. Our gas governor is the best. By-pass, gas valves and fittings.



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Recent Shipments
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**GAS TAPPING MACHINES**

—FOR—

**Drilling and Tapping Pipe under Pressure**

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

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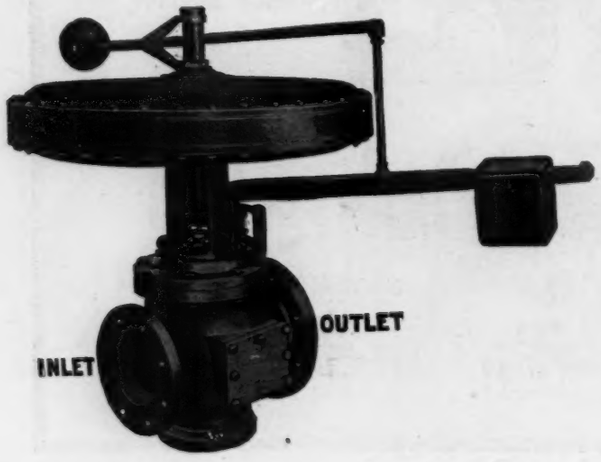


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**For Artificial or Natural Gas.**
**For District or Service Use.**

Our DUPLEX SENSITIVE GOVERNOR, with Automatic Cutoff for district service, will reduce high pressure gas to inches of water without variation.

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# AMERICAN METER CO.,

**NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,**

## Photometrical and Experimental Apparatus.


## PUBLIC LIGHTING TABLE.

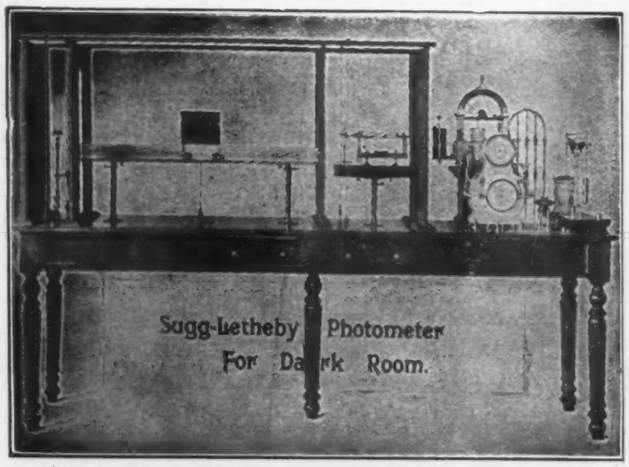
**JUNE, 1907.**

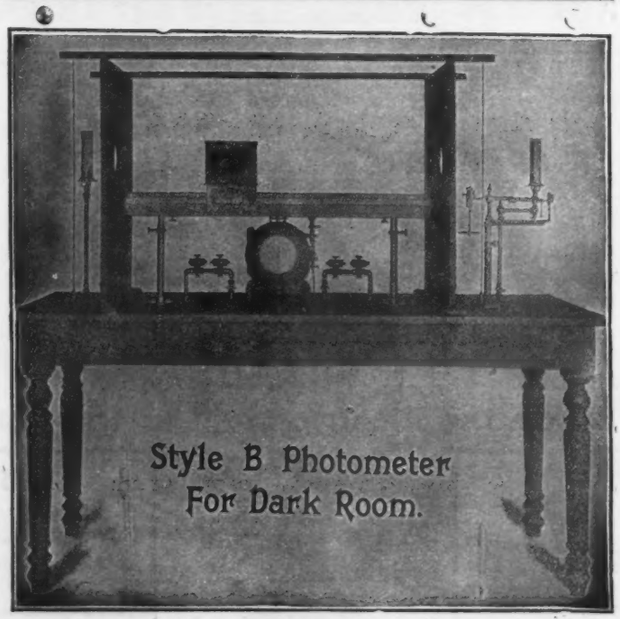
| Day of Week. | Table No. 1. FOLLOWING THE MOON. Date. | Light. | Extinguish. |
|---|---|---|---|
| Sat. | 1 | 7.50 PM | 1.20 AM |
| Sun. | 2 | 7.50 LQ | 1.50 |
| Mon. | 3 | 7.50 | 2.20 |
| Tue. | 4 | 7.50 | 2.50 |
| Wed. | 5 | 7.50 | 3.20 |
| Thu. | 6 | 7.50 | 3.30 |
| Fri. | 7 | 7.50 | 3.30 |
| Sat. | 8 | 7.50 | 3.30 |
| Sun. | 9 | 8.00 | 3.30 |
| Mon. | 10 | 8.00 NM | 3.30 |
| Tue. | 11 | 8.00 | 3.30 |
| Wed. | 12 | 8.00 | 3.30 |
| Thu. | 13 | 8.00 | 3.30 |
| Fri. | 14 | 8.00 | 3.30 |
| Sat. | 15 | 10.00 | 3.30 |
| Sun. | 16 | 10.30 | 3.30 |
| Mon. | 17 | 11.00 | 3.30 |
| Tue. | 18 | 11.30 FQ | 3.30 |
| Wed. | 19 | 12.00 | 3.30 |
| Thu. | 20 | 12.30 AM | 3.30 |
| Fri. | 21 | 1.00 | 3.30 |
| Sat. | 22 | 1.40 | 3.30 |
| Sun. | 23 | 2.20 | 3.30 |
| Mon. | 24 | No L. | No L. |
| Tue. | 25 | No L FM | No L. |
| Wed. | 26 | No L. | No L. |
| Thu. | 27 | 8.00 PM | 10.30 PM |
| Fri. | 28 | 8.00 | 11.10 |
| Sat. | 29 | 8.00 | 11.50 |
| Sun. | 30 | 8.00 | 12.30 AM |

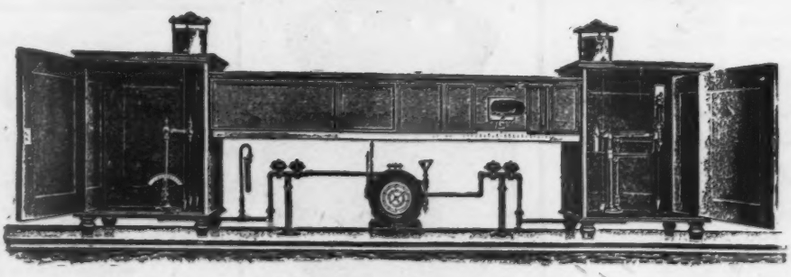
### TOTAL HOURS DURING 1907.

**By Table No. 1.**

| | Hrs.Min. |
|---|---|
| January | 211.10 |
| February | 193.40 |
| March | 182.10 |
| April | 167.00 |
| May | 157.00 |
| June | 145.30 |
| July | 151.50 |
| August | 162.30 |
| September | 175.30 |
| October | 202.40 |
| November | 209.30 |
| December | 231.50 |
| Total, yr. | 2190.20 |



Closed Photometer For Light Room.

**CIRCULARS SENT ON REQUEST.**

## PUBLIC LIGHTING TABLE.

**JUNE, 1907.**

| Day of Week. | Table No. 2. NEW YORK CITY. All Night Lighting. Date. | Light | Extinguish. |
|---|---|---|---|
| | | P. M. | A.M. |
| Sat. | 1 | 7.15 | 3.15 |
| Sun. | 2 | 7.15 | 3.15 |
| Mon. | 3 | 7.15 | 3.15 |
| Tue. | 4 | 7.25 | 3.15 |
| Wed. | 5 | 7.25 | 3.15 |
| Thu. | 6 | 7.25 | 3.15 |
| Fri. | 7 | 7.25 | 3.15 |
| Sat. | 8 | 7.25 | 3.15 |
| Sun. | 9 | 7.25 | 3.15 |
| Mon. | 10 | 7.25 | 3.15 |
| Tue. | 11 | 7.25 | 3.15 |
| Wed. | 12 | 7.25 | 3.15 |
| Thu. | 13 | 7.25 | 3.15 |
| Fri. | 14 | 7.25 | 3.15 |
| Sat. | 15 | 7.25 | 3.15 |
| Sun. | 16 | 7.25 | 3.15 |
| Mon. | 17 | 7.25 | 3.15 |
| Tue. | 18 | 7.30 | 3.15 |
| Wed. | 19 | 7.30 | 3.15 |
| Thu. | 20 | 7.30 | 3.15 |
| Fri. | 21 | 7.30 | 3.15 |
| Sat. | 22 | 7.30 | 3.15 |
| Sun. | 23 | 7.30 | 3.15 |
| Mon. | 24 | 7.30 | 3.15 |
| Tue. | 25 | 7.30 | 3.15 |
| Wed. | 26 | 7.30 | 3.15 |
| Thu. | 27 | 7.30 | 3.15 |
| Fri. | 28 | 7.30 | 3.15 |
| Sat. | 29 | 7.30 | 3.15 |
| Sun. | 30 | 7.30 | 3.15 |

### TOTAL HOURS DURING 1907.

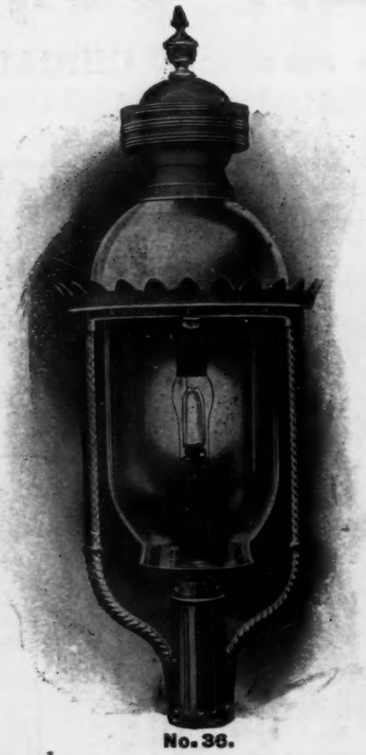
**By Table No. 2.**

| | Hrs.Min. |
|---|---|
| January | 423.20 |
| February | 355.25 |
| March | 355.35 |
| April | 298.50 |
| May | 264.50 |
| June | 234.25 |
| July | 243.45 |
| August | 280.25 |
| September | 321.15 |
| October | 374.30 |
| November | 401.40 |
| December | 433.45 |
| Total, yr. | 3987.45 |

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

# WELSBACH STREET LIGHTING COMPANY

....OF AMERICA....



No. 36.

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

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**Succeeds and Excels the Electric Light at One-Quarter the Cost.**

**THE BURNER.**

Elegance of Appearance.
Best Possible Material and Workmanship.
Perfect Combustion.
Lowest Gas Consumption.
Highest Candle Power.
Will Fit Any Fixture.
Will Not Flash Back.
Will Not Blacken Mantles.
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**THE MANTLE.**

Best Welsbach Quality.
Extra Strong and Durable.
Highest Maintained Candle Power.
Rich Mellow Light.

**THE GLASSWARE.**

Highest Quality Imported.
Special Design Inner Cylinder (No. 317).
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Increases Candle Power.

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LARGEST BUILDERS OF

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## SOLE BUILDERS

OF THE

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## 1906 CONTRACTS.

**PARTIAL LIST OF PLACES:**

**New Britain, Conn.** (2d contract).
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**Kirksville, Mo.**
**St. Johnsbury, Vt.**
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**Council Bluffs, Ia.** (2d contract).
**Seattle, Wash.** (2d contract).
**Philadelphia, Pa.**
**Waterbury, Conn.**
**Manchester, N. H.**
**Allentown, Pa.**
**Omaha, Neb.**
**Muskegon, Mich.**
**Nazareth, Pa.** (2d contract).
**Lewistown, Pa.**
**Greenville, Tex.**
**New York,** Cent. Un. (3d contract).
**Jefferson City, Mo.**
**Peeksk·ll, N. Y.** (2d contract).
**Waterville, Me.**
**Washington, D. C.** (4th contract).
**Lawrence, Mass.** (3d contract).
**Hampton, Va.**
**Aurora, Ills.** (2d contract).
**Milwaukee, Wis.**
**Syracuse, N. Y.** (2d contract).
**Davenport, Ia.**
**S. Brooklyn, N. Y.** (3d contract).
**Delray, Mich.**
**Albert Lea, Minn.** (2d contract).
**Leominster, Mass.** (2d contract).
**Clinton, Mass.**

TOTAL SETS INSTALLED IN 1906, . . . . . 41
TOTAL SETS TO DATE, . . . . . 634
TOTAL DAILY CAPACITY, . . . . . 502,555,000 cu. ft.

Tar Extractors for Carburetted Water Gas.
Photometrical Apparatus.
Gas Analysis Apparatus.
Recording Gauges.
Straight Standpipe System for Coal Gas Retorts.
Straight Standpipe Cleaners.

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HALF AND FULL DEPTH AND FREE FIRING BENCHES,

All styles of which we have in operation, equipped with the BEST of LATEST IMPROVEMENTS, proving our claim for SUPERIOR QUALITY and EFFICIENCY.

INCLINES—We have in SUCCESSFUL OPERATION benches of Inclined Retorts, MANUFACTURED and ERECTED by us.

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RAIL and WATER CONNECTIONS to ALL POINTS.

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"CHRISTY" HIGH GRADE REFRACTORY MATERIAL FOR BENCH SETTINGS, WATER GAS LININGS, ETC.

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**GEROULD'S IMPROVED RETORT CEMENT.**

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

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In Kegs, 100 to 200 " " 6 " "
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Modern Machine Shop Construction, Equipment and Management, by OSCAR E. PERRIGO, M.E.
Price, $3. For Sale by
A. M. CALLENDER & CO., 42 Pine St., New York City.

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ESTABLISHED 1882.

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12-Inch High Pressure Governor.

**REYNOLDS' GAS REGULATOR COMPANY,**

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We make all sizes for all classes of reduction,

DOUBLE and SINGLE DISTRICT STATIONS,

And Individual Service Governors for Reducing High Pressure.

HOLDER GOVERNORS

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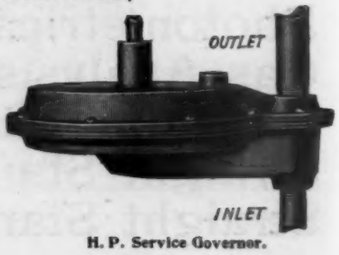


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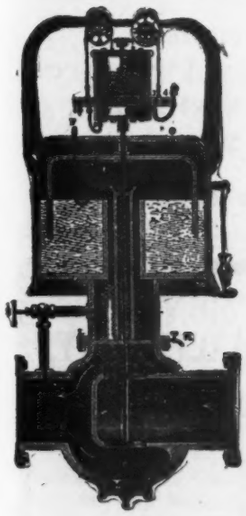

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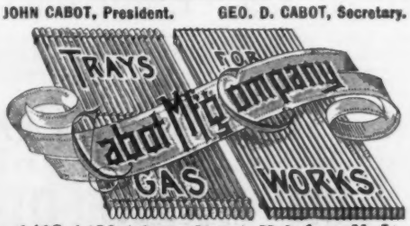


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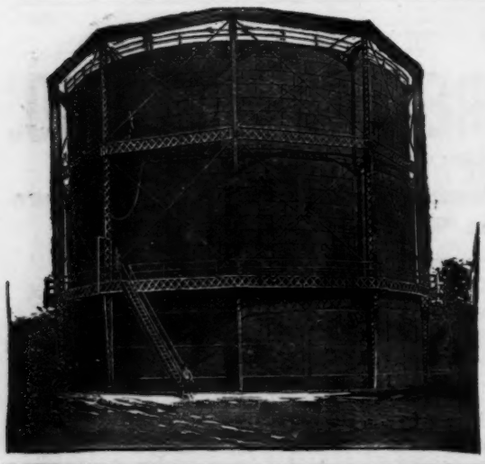

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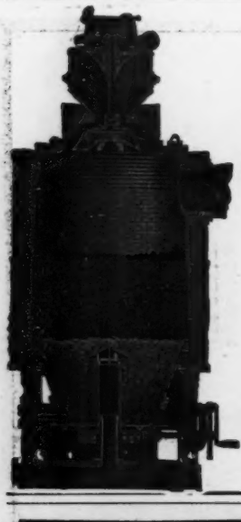

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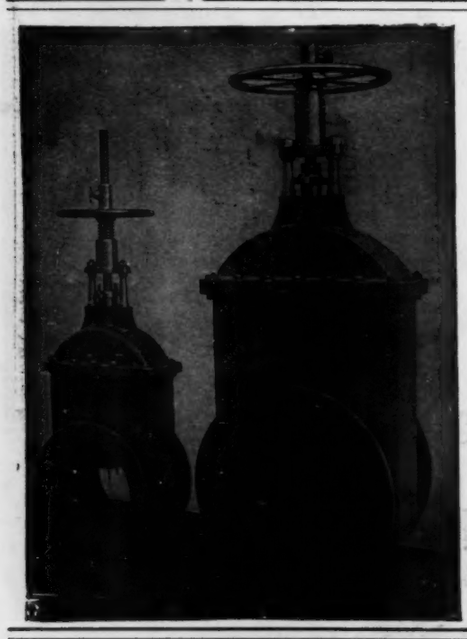

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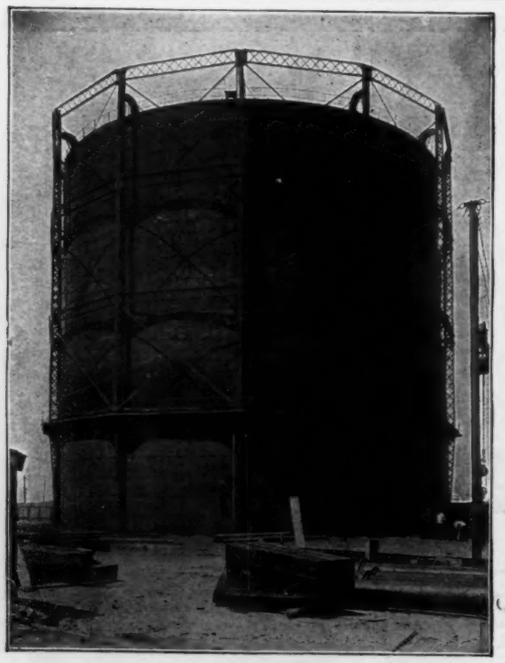

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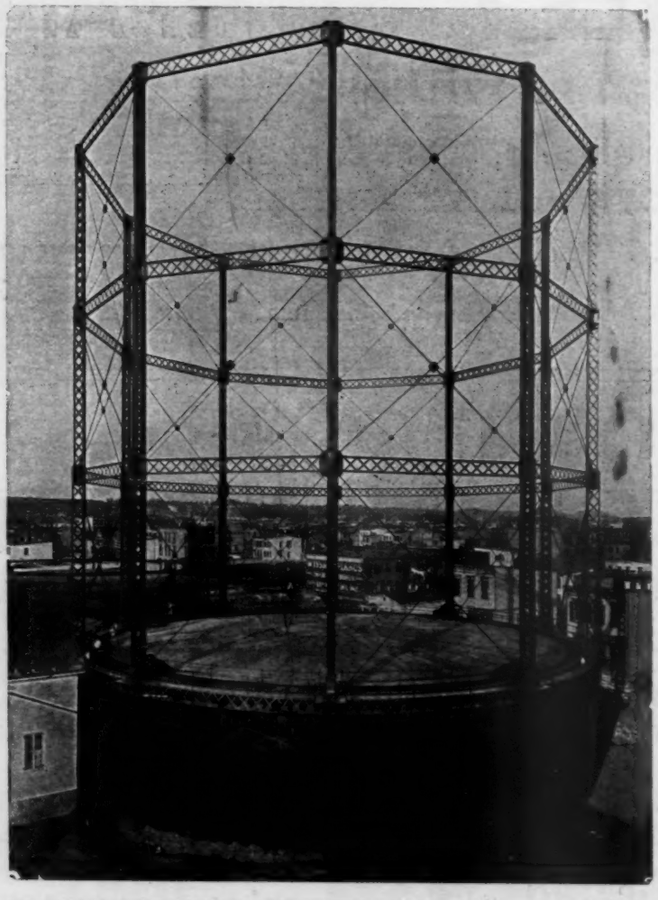

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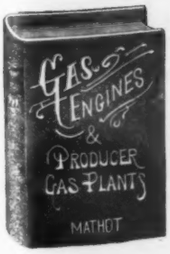


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